AUTOMATED TRAINING FOR RETARDED PERSONS

By

MICHAEL R. STOUTIMORE

A DISSERTATION PRESENTED TO THE GRADUATE SCHOOL
OF THE UNIVERSITY OF FLORIDA IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOTHY

UNIVERSITY OF FLORIDA

1988

TABLE OF CONTENTS

Abstract of Dissertation Presented to the Graduate School
of the University of Florida in Partial Fulfillment of the
Requirements for the Degree of Doctor of Philosophy

AUTOMATED TRAINING FOR RETARDED PERSONS

By

MICHAEL R. STOUTIMORE

December, 1988

Chairman: Henry S. Pennypacker
Major Department: Psychology

Retarded people need training alternatives that are effective, beneficial, and economically practical. Automated training focused on aspects of repertoires fundamental to a wide range of skills, rather than on specific skills, would provide such an alternative.

Six retarded persons were exposed to automated laboratory training of processes fundamental to complex stimulus discriminations. These processes included simple discriminations, identity, and non-identity conditional discriminations. The effects of this training were assessed in a non-laboratory setting on four standard procedures (Look-Say, Listen-Find, Look-Find, and Listen-Say) that typically have been arranged to establish basic language repertoires.

The non-laboratory performances of four of the six subjects improved significantly during laboratory training. Furthermore, the non-laboratory performances of five of the six subjects improved after laboratory training was discontinued. Only one subject did not demonstrate improved acquisition of stimulus control functions with respect to the four non-laboratory procedures. However, although the pre-laboratory baseline performance of this subject was comparable to the others, he was the only one of the six to meet the acquisition criterion for non-identity conditional discriminations in the laboratory.

The performance of all but one of the subjects was superior in the non-laboratory as opposed to laboratory setting. Whereas numerous exemplars of non-identity conditional discriminations were acquired in the non-laboratory setting, and identity conditional discriminations were acquired without difficulty, acquisition of even identity conditional discriminations was painfully slow in the laboratory setting. The identification of variables responsible for these performance variations is critical to further development of this training approach.

INTRODUCTION

Behavioral phenomena that have an identifiable temporal pattern under specified conditions and which are reproducible in different individuals are the foundation of learning and may be described as "reproducible behavioral processes" (Skinner, 1953; Zimmerman 1963). These behavioral processes may be viewed as classes of behavior change that result from classes of environmental events, and may occur "naturally" as the organism acts upon the inanimate environment, or they may be arranged by another organism as in various forms of social or verbal behavior.

A distinction has been made between "operations" as experimental procedures that are imposed by the environment and "processes" as the behavioral effects of these procedures (Catania 1973, p. 33; Ferster & Skinner, 1957, p. 730). Examples of environmental operations are 1) the simple presentation of stimuli, 2) the presentation of consequences for responses, and 3) stimulus control operations (the arrangement of stimuli to signal events such as the presentation of other stimuli or the opportunity to produce consequences). The behavioral processes corresponding to these environmental arrangements (or operations) are referred to as 1) elicitation, when a stimulus produces responses; 2) reinforcement, when a consequent operation leads to an increase in the subsequent probability of responding; 3) punishment, when a consequent operation leads to a decrease in the subsequent probability of responding; and 4) discrimination, when responding is said to be under the control of a discriminative stimulus (see Catania, 1984).

All humans differ with respect to these reproducible behavioral processes either qualitatively or quantitatively. Qualitative differences, generally referred to as "skills," arise as varying operant or discriminated operant relations are differentially acquired. These discriminated operant relations include the complex discriminations of classes of stimuli referred to as abstractions, extensions, and concepts (Skinner, 1957, pp. 91-129). An individual's repertoire may comprise any number of these qualitative processes.

Quantitative differences between the changes within the measurable dimensions of particular processes can be identified as well. For example, Skinner (1953) states that "the 'intelligent' individual . . . is commonly supposed to show more rapid conditioning and extinction, to form discriminations more rapidly, and so on" (p 196). Variations in latency, duration, count, frequency, celeration, and inter-response times with respect to behavioral change can "characterize an individual just as the physical constants of thermal conductivity, electrical conductivity, specific gravity, and so on characterize materials" (Skinner, 1953, p 197).

An understanding of the variables controlling the qualitative and quantitative aspects of behavioral processes, and the possession of educational rules to change both, is critical to a science of behavior. Changes in the measurable dimensions of the behavior of retarded persons may be characterized more as "deficits" than as "skills". Retarded people show slower conditioning and extinction, form discriminations more slowly, and so on. Therefore, analyses of the behavior of retarded persons may facilitate the understanding of learning, abilities, and/or behavioral processes.

Retarded persons learn relatively little from their daily commerce in the environment as compared to others, and therefore efforts to "habilitate" them take the form of creating prosthetic environments designed to augment their acquisition of a variety of basic skills. Although the design of these special training procedures is well understood, achieving their routine use in retardation settings turns out to be a difficult challenge because of innumerable constraints. The laundry list of complications begins with poorly motivated personnel who have little or no training in behavioral procedures, who are supervised by individuals only marginally better in both respects, and includes a welter of bureaucratic contingencies that collectively discourage good training.

While efforts are underway to change this status quo, there is an alternative approach to training that warrants serious exploration. This approach may be described as "automated training," and it should be seen as one component of the array of prosthetic training environments necessary for the behavioral habilitation of retarded individuals. Actually, the phrase "automated training" encompasses a variety of different functions, some already fairly well established and others still unexamined. However, they have in common a dependence on a relatively carefully controlled training environment and procedures.

It has been suggested (Skinner, 1954, 1961a, 1961b, 1968) that automated training has at least eight advantages over a human trainer: 1) instruction is individualized and self-paced; 2) manipulation of the device is reinforced; 3) reinforcement is immediate and frequent; 4) subtle and precise reinforcement contingencies can be arranged; 5) teachers can spend more time in those areas where a student-teacher relation cannot be mechanized; 6) instruction follows a coherent sequence; 7) the drudgery of repetitive teaching is reduced; and 8) a machine is not prejudiced and has infinite patience.

One well-established use of automated training is for purposes of assessment (Holtzman, 1970). The testing of vision and hearing in retarded individuals is often accomplished with varying degrees of automation (Hively, 1964; Holland and Matthews, 1963); and in some instances the process is fully automated (Ferster and DeMeyer, 1961). Such automated procedures are especially necessary when the client is unable or unwilling to cooperate. However, the procedural technology here is actually far more capable than these familiar applications suggest. In fact, quite a range of behavioral capabilities can be sensitively and accurately assessed using particular behavioral procedures under highly controlled conditions (Sidman and Stoddard, 1967).

Another use of automated training is increasingly common, at least outside of retardation facilities: the use of programmed electro-mechanical equipment or micro-computers with modern software to teach directly a variety of educational and other skills (Carter, 1961; Engstrom and Whitaker, 1963; Gutkin, 1985; Malpass, Hardy, Gilmore, and Williams, 1964; Price, 1963; Stolurow, 1960). For instance, a special education teacher can train basic academic and some daily living skills in one-on-one or small group sessions using sound behavioral procedures, or he or she can give the client a few basic pre-requisite computer skills (sitting still, looking at the monitor, hitting keys, etc.) and then let the software do the rest. In other words, this category of automated training applications includes arranging for equipment to train the same things that a teacher might, but the rationale for the automated alternative is based on evidence that it is faster, better, and/or cheaper.

Still another application of the automated training notion is far less obvious, although its impact might be powerfully pervasive. It involves developing procedures for use in highly controlled training environments that address the most basic behavioral processes, and the deficits with respect to these processes that characterize many retarded persons; these deficits concern attending, stimulus discrimination, response differentiation, discriminated extinction, and so forth. As previously stated, these behavioral processes are at the root of all learning, and it is deficits in these areas that explain the difficulties that retarded people have in learning from their daily experiences, let alone explicit training situations. Of course, these deficits presumably have a biological base (i.e., are the result of variables other than contingencies of reinforcement, such as genetics or injury), but that fact of life is usually beyond remediation.

A strategy for addressing behavioral processes was suggested by the research of Harlow (1949, 1950, 1959).

Harlow referred to sources of stimulus control that compete with the relations specified through training as interfering "factors" that are disruptive to the conditioning, extinction, and the acquisition of discriminations. Responses occasioned by these factors were referred to as "errors" and the most typical "error factors" were classified as 1) stimulus-perseveration, 2) differential-cue, 3) response-shift, and 4) position-habit. Furthermore, Harlow suggested the possibility of enhancing performance by eliminating individual error factors before the beginning of formal training in test situations. He referred to improved performance with respect to the "correct" factors, arranged by the experimenter or trainer, as "learning sets" or "hypotheses". Learning sets may be considered a class of relations or arrangements that exert stimulus control for a class of correct responses.

The present application of the automated training concept was an attempt to both eliminate "error factors" and ameliorate fundamental behavioral deficits. This attempt was made under conditions similar to those of a human operant laboratory, both because such control makes it easier to optimize all of the factors that enhance learning, and because the necessary training procedures are generally those that are used in operant research. The goal was to expose subjects to a sequence of extensive training procedures that would actually improve their basic learning abilities, so that these new "skills" would augment the effectiveness of training procedures conducted in more typical training environments. The rationale for this category of applications of automated training thus goes beyond the possibilities of faster, better, and cheaper; here this approach may be the only way to conduct this type of training effectively.

Discriminated responding was selected in this project because this complex process is comprised of a number of basic behavioral processes and is essential to a number of fundamental repertoires. Establishing various discriminations is the goal of a variety of training programs involving the skill areas commonly referred to as basic academics, communication, and vocational training. To illustrate the importance of stimulus discriminations, Sidman & Tailby (1982) identified terms utilized in the traditional psycholinguistic literature that pertain to several stimulus relations and that pervade human verbal behavior or language. Examples include auditory comprehension, reading comprehension, and oral reading. "Auditory comprehension" describes the conditional discrimination produced by the operation of reinforcing responses that match auditory to visual stimuli. "Reading comprehension" specifies a conditional discrimination of visual stimuli, an object paired with a textual stimulus. Finally, "oral reading" pertains to the vocal production of an acoustic stimulus occasioned by a textual stimulus, a discriminatively controlled vocal differentiation.

This research project was an attempt to assess the effects of laboratory training (independent variable) on the acquisition of language relations trained in a non-laboratory environment (dependent variable). Laboratory training was designed to 1) eliminate competing sources of stimulus control and 2) establish or enhance the control exerted by particular process relations. In contrast to traditional training procedures, this project was designed to address both the qualitative and quantitative aspects of behavior at the level of processes. Automated laboratory training was arranged to address the acquisition of fundamental generic behavioral processes such as reinforcement, extinction, simple and conditional stimulus discriminations, discriminated extinction, and response differentiation. Dissimilar stimuli were selected for laboratory and non-laboratory training to minimize the generalization between specific stimuli. The only basis for generalization, and the facilitation of acquisition, was between similar stimulus relations, or between relations comprised of similar processes.

The generic question this study was designed to address was as follows: Can automated training alter the repertoires of retarded individuals with respect to basic behavioral processes and thereby facilitate the future acquisition of new stimulus/response relations in a non-laboratory training environment?

As the independent variable, subjects received automated laboratory training including a variety of discriminations with visual stimuli that were formally different than those used in standard training settings. These laboratory procedures comprised three procedural phases presented in the following order 1) preliminary training, including magazine training and simple discriminations, 2) a matching-to-sample procedure with only one stimulus pair trained at a time, and 3) a conditional discrimination (identity and non-identity matching) procedure.

As a dependent measure, subjects received "standard" non-laboratory "language" training from University of Florida undergraduate students. Four assessment procedures were used: Look-Say, Listen-Find, Look-Find, and Listen-Say. Latencies correct and incorrect were recorded from the opportunity to respond to the beginning of a response. This training occurred prior to and simultaneously with the independent variable condition.

The independent variable was designed to address the following question: What are the effects of repeated exposure to shaping, simple, and conditional discrimination contingencies in an automated laboratory environment (without intervening social contingencies or instructions) on acquisition of the skills addressed in standard training programs? Phases were designed to shape responding and establish simple and conditional discriminations. In keeping with the concept of "process" generalization, common behavioral relations (as opposed to common stimuli) were programmed.

METHOD

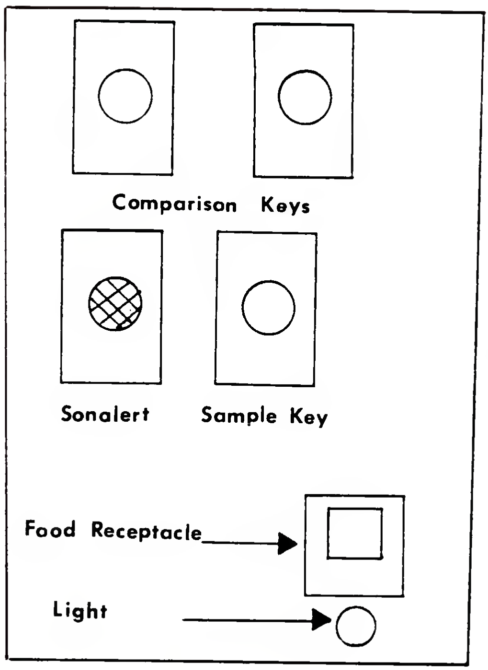
Subjects

Six residents of Sunland Center, Gainesville served as subjects. RG was a 41 year old male, DC was a 32 year old female, TM was a 30 year old male, KD was a 35 year old male, LT was a 49 year old female, and KM was a 28 year old male. All subjects scored on intelligence and adaptive tests (Stanford-Binet and Vineland Adaptive Behavior Scales, respectively) within the Profound to Severe range of mental retardation (see Appendix A). All subjects were capable of articulating the labels of pictures used on the Peabody Picture Vocabulary Test, and displayed limited expressive and receptive communicative repertoires.

Apparatus (Laboratory)

Laboratory sessions were conducted in a sound attenuating 6 X 8 foot room dimly illuminated from above. Subjects were seated before a panel containing translucent response keys illuminated from the rear by in-line stimulus projectors. The arrangement of keys is shown in Figure 1. Subjects were observed through a one-way plexiglass window located above the panel. A universal feeder delivered a

Figure 1. Diagram of the laboratory apparatus including the sample and comparison keys upon which stimuli were projected, the sonalert, and the food receptacle with receptacle light.



Response Panel

variety of food items into a receptacle located just below and to the right of the sample key. Food items included small pieces of cereal (e.g., Fruit Loops) and candy (e.g., M & M's, candy corn, and mini-marshmallows). When the universal feeder was operated, the food receptacle was illuminated by a white light and a tone was sounded from a sonalert panel next to the response keys.

Each stimulus projector was loaded with a piece of film comprising twelve stimulus configurations. When projected on the response keys, each stimulus was approximately the same size (1 X 1 inch) but consisted of a formally distinct combination of lines (see Figure 2). This arrangement, involving a minimum number and an established location of sample and comparison keys as well as distinct and salient stimuli, was designed to simplify and therefore facilitate the acquisition of multiple discriminations.

Apparatus (Non-Laboratory)

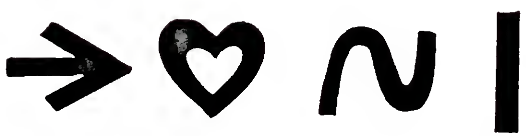
Subjects were seated at a table directly across from a trainer. Two identical sets of four pictures used as stimuli and food items used as reinforcers were kept beside the trainer. Pictures were copied from the Peabody Picture Vocabulary Test, cut into 3 X 5 cards, and laminated. Food items consisted of small pieces of cereal (e.g., Fruit Loops) or candy (e.g., M & M's, pieces of candy corn, and mini-marshmallows). A stopwatch with a countdown function

Figure 2. The stimulus configurations used in laboratory training are numbered and presented in their respective sets.

Laboratory Stimuli

1 2 3 4

Set One



5 6 7 8

Set Two

9 10 11 12

Set Three

was used to record expired time and a specifically designed data sheet was used for recording.

Procedure (Laboratory)

The independent variable (automated laboratory training) consisted of three components: Preliminary training, matching-to-sample, and conditional discrimination procedures. The dependent variable consisted of assessments and re-assessments with respect to four procedures (Look-Say, Listen-Find, Look-Find, and Listen-Say). Table 1 presents total sessions/condition across all six subjects.

Within each trial, during all phases, a response on the key designated as correct by the experimenter was immediately followed by the simultaneous termination of all stimulus lights and the presentation of food, the food receptacle light, and a brief (one second) tone. The end of the tone initiated an inter-trial interval (5-15 seconds). A response designated as incorrect by the experimenter resulted in the termination of all stimulus lights, the initiation of a time out period, and the subsequent re-initiation of that trial. The time out period ranged from 15 to 60 seconds and was always longer than the inter-trial interval. Parameters were lengthened for some subjects in an attempt to improve their motivation. Responses during the time out or inter-trial interval re-initiated that particular interval. Sessions

Table 1

Laboratory and Non-laboratory Sessions/Condition Across Subjects

NUMBER OF LABORATORY SESSIONS

Subject	Phase 1	Phase 2	Phase 3	Phase 4	Total
RG	3	23	54	0	80
DC	3	17	87	0	107
TM	6	16	43	44	109
KD	3	79	0	0	82
LT	21	147	0	0	168
KM	17	63	0	0	80
Subtotal	53	345	184	44	626

NUMBER OF NON-LABORATORY SESSIONS

Subject	Pre-lab	Lab	Post-lab	Total
RG	32	89	58	179
DC	34	109	31	174
TM	150	75	158	383
KD	176	81	93	350
LT	112	162	32	306
KM	175	84	82	341
Subtotal	679	600	454	1733

Total Sessions 2359

continued for 15 minutes, unless the criterion for correct responses was met earlier.

Phase 1: Preliminary Training

Step 1. Magazine training involved the delivery of food in the presence of the tone and food receptacle light. Once food items were reliably obtained with short latencies, this procedure advanced to step number two.

Step 2. A stimulus (e.g., stimulus number 1) was projected on the sample key. Successive approximations to pressing, and finally pressing the sample key, were designated as correct responses. No consequences were programmed for presses on any other keys. Presses on the unlit sample key during inter-trial intervals were designated as incorrect. The procedure advanced to Phase 2 in subsequent sessions after steady lighted-sample key pressing was observed.

Phase 2: Matching-To-Sample Training

Step 1. This step involved one comparison stimulus. This procedure (matching-to-sample) proceeded from stimulus 1 through 12. A stimulus (e.g., stimulus 1) was projected on the sample key. A press of that key resulted in that stimulus remaining lighted and the projection of the same (identical) stimulus on one of the two comparison keys (position determined arbitrarily). The other comparison key remained dark. A response to the lighted comparison key was designated as correct, and a response to the other comparison key or a repeated response to the sample was designated as incorrect. Ten consecutive correct responses advanced this procedure within session to step number two. After the first session that a stimulus was introduced, the criterion for advancing to step two was decreased to five consecutive correct responses.

Step 2. This step involved two comparison stimuli. The twelve stimuli loaded into each stimulus proector were divided into three subsets (1-4, 5-8, and 9-12). A sample stimulus was selected from a set, and stimuli used as incorrect comparisons on a trial were arbitrarily selected from the remaining members of that set. For example, incorrect comparison stimuli used for sample number 1 were the stimuli numbered 2, 3, and 4; incorrect comparisons for sample number 6 were the stimuli numbered 5, 7, and 8; and so on. The same stimulus as in step number one (e.g., stimulus number 1) was projected on the sample key. A response to that key resulted in the simultaneous projection of that stimulus arbitrarily on one of the two comparison keys and the projection of another stimulus from that set (e.g., stimulus number 2, 3, or 4) on the other comparison key. A response to the comparison key with the formally identical stimulus was specified as correct, and any other response was specified as incorrect. Ten consecutive correct responses ended the session. The next session began with step number one of Phase 2 and, after criterion was met on an individually specified number of successive sessions, a new stimulus was introduced, again beginning with step number one of Phase 2.

Phase 3: Conditional Discrimination Training (Identity Matching)

Step 1. Conditional discriminations were trained within sessions in pairs. One stimulus (e.g., stimulus number 1) of a pair of two stimuli (e.g., stimulus numbers 1 and 2) was projected on the sample key. A response (press) to that key resulted in that stimulus remaining lighted and the projection of the same (identical) stimulus arbitrarily on one of the two comparison keys. The other key remained dark. A response to the lighted comparison key on which the stimulus was projected was specified as correct, and a response to the other comparison key or a repeated response to the sample was specified as incorrect. After correct responses, either the same stimulus or the other stimulus from that training pair (e.g., stimulus number 2) was projected on the sample key (position selected arbitrarily). The remainder of the step one Phase 3 procedure continued as before. An individually specified number of consecutive correct responses advanced this procedure within session to step number two.

Step 2. Each of the stimuli from the stimulus pair used in step number one in this session (e.g., stimulus numbers 1 and 2) were projected arbitrarily on the sample key. A response to the lighted sample key resulted in the simultaneous projection of the same stimulus (e.g., stimulus number 1) quasi-randomly on one of the two comparison keys and the projection of another stimulus from that set (e.g., stimulus 2, 3, or 4) on the other comparison key. A response to the comparison key with the identical stimulus was specified as correct and any other response as incorrect. After correct responses, either the same stimulus or the other stimulus from that training pair (selected at random) was projected on the sample key and the remainder of the step two Phase 3 procedure continued as before. Ten consecutive correct responses ended the session. The next session began with step number one of Phase 3 and, after criterion was met on an individually specified number of successive sessions, a new pair of stimuli was introduced, again beginning with step number one of Phase 3.

<u>Phase 4: Conditional Discrimination Training (Non-identity Matching)</u>

<u>Step 1</u>. Conditional discriminations were trained within sessions in pairs. One stimulus (e.g., stimulus number 1) of a pair of two stimuli (e.g., stimulus numbers 1 and 5; 5 and 9) was projected on the sample key. A response (press) to that key resulted in that stimulus remaining lighted and the projection of a formally dissimilar stimulus from another set arbitrarily on one of

the two comparison keys. The other key remained dark. A response to the lighted comparison key was specified as correct, and a response to the other comparison key or a repeated response to the sample was specified as incorrect. After correct responses, either the same stimulus or the other stimulus from that training pair (e.g., stimulus number 5) was arbitrarily projected on the sample key. The remainder of the step one Phase 4 procedure continued as before. Ten consecutive correct responses advanced this procedure within session to step number two.

Step 2. Each of the stimuli from the stimulus pair used in step number one in this session (e.g., stimulus numbers 1 and 5; 5 and 9) were projected arbitrarily on the sample key. A response to the lighted sample key resulted in the simultaneous projection of a formally dissimilar stimulus from another set (e.g., stimulus number 5) arbitrarily on one of the two comparison keys and the projection of another stimulus from that set (e.g., stimulus 6, 7, or 8) on the other comparison key. A response to the comparison key with the specified non-identity stimulus was designated as correct and any other response as incorrect. After correct responses, either the same stimulus or the other stimulus from that training pair (selected at random) was projected on the sample key and the remainder of the step two Phase 4 procedure continued as before. Ten consecutive correct responses ended the session. The next session began with step number one of Phase 4 and, after criterion was met on an individually specified number of successive sessions, a new pair of stimuli was introduced, again beginning with step number one of Phase 4.

Assessment Procedure (Non-Laboratory)

Stimulus control was assessed with each stimulus picture via four procedures: 1) Look-Say, 2) Listen-Find, 3) Look-Find, and 4) Listen-Say. All pictures were assessed in an arbitrary order within each procedure before beginning the next procedure. The order of assessment always proceeded from procedure 1 through 4 (Look-Say, Listen-Find, Look-Find, and finally Listen-Say). Praise was delivered after each correct response and an edible (paired with praise) was delivered intermittantly for correct responses. The acqusition criterion for a stimulus pair (the visual stimulus and its label) was correct responding with respect to all four procedures for three consecutive assessments (assessment or re-assessment).

Look-Say. The subject was seated at a table across from the experimenter. The stimulus pictures were hidden from the subject's view. The experimenter presented a stimulus picture (chosen arbitrarily from the four) at chest level and recorded the beginning of the trial (pressed "start" on the countdown), simultaneously asking the question "What is this?". The first vocal response emitted by the subject was recorded as his/her answer and its time of emission was recorded as the end of the trial (experimenter pressed "stop" on the countdown). During the inter-trial interval (ITI) (approximately ten seconds long) the experimenter recorded on a data sheet the subject's response (correct, incorrect, or no response), its latency (time from stimulus presentation to response), and reset the countdown function on the stopwatch. At the end of the ITI the experimenter arbitrarily chose another stimulus picture from the remaining three and repeated the procedure. This procedure was repeated again with both of the remaining two stimulus pictures.

Listen-Find. The setting was identical to the Look-Say procedure. The experimenter arbitrarily selected a picture from one stimulus set (set number 1). This picture was kept out of sight of the subject. The corresponding stimulus and the other three stimuli from set number 2 were arranged at the center of the table spaced approximately two inches apart. The experimenter said "Point to (or 'where is') the __________," completing the sentence with the label (corresponding acoustic stimulus) of the set number 1 stimulus picture. The experimenter recorded the end of this question as the beginning of the trial (pressed "start" on the countdown). The first picture pointed to by the subject was recorded as his/her answer and the experimenter pressed "stop" on the countdown, ending the trial and recording the latency of the subject's response. During the ITI (approximately 10 seconds) the experimenter recorded on a data sheet the subject's response (correct, incorrect, or no response), its latency, and reset the countdown function on the stopwatch. The experimeter then arbitrarily selected another stimulus picture from set number 1 as the next sample, and arranged the set number 2 comparison stimuli on the table. The experimenter repeated the procedure until stimulus control with all pictures and their labels was assessed.

Look-Find. The setting was identical to the Look-Say and Listen-Find procedures. The experimenter arbitrarily selected a stimulus picture from one stimulus set (set number 1). The picture was kept out of sight of the subject until the beginning of a trial. The corresponding stimulus and the other stimulus pictures from set number 2 were arranged at the center of the table spaced approximately two inches apart. The experimenter presented the stimulus picture from set number 1 at chest level, pointed to it, asked "Where is this one?", and recorded the beginning of the trial (pressed "start" on the countdown function of the stopwatch). The first picture pointed to by the subject was recorded as his/her answer and the experimenter pressed "stop" on the countdown, ending the trial and recording the latency of the subject's response. During the ITI (approximately 10 seconds) the experimenter recorded on a data sheet the subject's response (correct, incorrect, or no response), its latency, and reset the countdown function on the stopwatch. The experimenter also arbitrarily selected another stimulus picture from set number 1, and repeated the procedure until stimulus control with all pictures was assessed.

Listen-Say. The setting was identical to the Look-Say, Listen-Find, and Look-Find procedures. The experimenter arbitrarily selected a stimulus picture from one stimulus set (set number 1). The picture was kept out of sight of the subject. The experimenter said "Say __________," completing the sentence with the label of the selected set number 1 stimulus. The experimenter recorded the end of this question as the beginning of the trial (pressed "start" on the countdown function of the stopwatch). The first vocal response emitted by the subject was recorded as his/her answer and its time of emission was recorded as the end of the trial (experimenter pressed "stop" on the countdown). During the ITI (approximately 10 seconds) the experimenter recorded on the data sheet the subject's response (correct, incorrect, or no response), its latency (time from stimulus presentation to response), and reset the countdown function of the stopwatch. At the end of the ITI the experimenter arbitrarily chose another stimulus picture from the remaining three and repeated the procedure. This procedure was repeated until stimulus control was assessed with all of the remaining stimuli.

Teaching Procedure (Non-Laboratory)

Praise was delivered after each correct response and an edible was delivered intermittently for correct responses. Edibles were always handed to the subject or placed on the table directly in front of him/her. Data were not recorded during teaching.

The procedures that were taught within each session were determined by the assessment. Specifically, if any responses from the Look-Find procedure were incorrect, then this procedure was the focus of teaching. Alternately, if all responses from the Look-Find procedure were correct, then one focus was the Listen-Find procedure. If Listen-Say responses were all correct, then teaching addressed Listen-Find and Look-Say. If any Listen-Say responses were incorrect, then the Listen-Find and Listen-Say procedures were taught.

Listen-Say teaching involved the repetition of the Listen-Say assessment procedure. When articulation was a problem, the echoic responses of syllables were reinforced.

Look-Find teaching involved the repetition of the Look-Find assessment procedure. Furthermore, the sample picture was placed next to its corresponding comparison stimulus picture and the distance faded-in to chest level as the proportion of correct responses increased.

Look-Say and Listen-Find procedures always were simultaneously taught. This involved beginning with the Listen-Find procedure but with only one available comparison stimulus. Time between the experimenter's presentation of the picture label (in the Listen-Find procedure) and the Look-Say question was faded-in. Also, additional stimulus pictures were faded-in in an errorless fashion after the repetition of correct responses.

<u>Re-Assessment Procedure (Non-Laboratory)</u>

At the end of each session the assessment procedure was repeated.

RESULTS

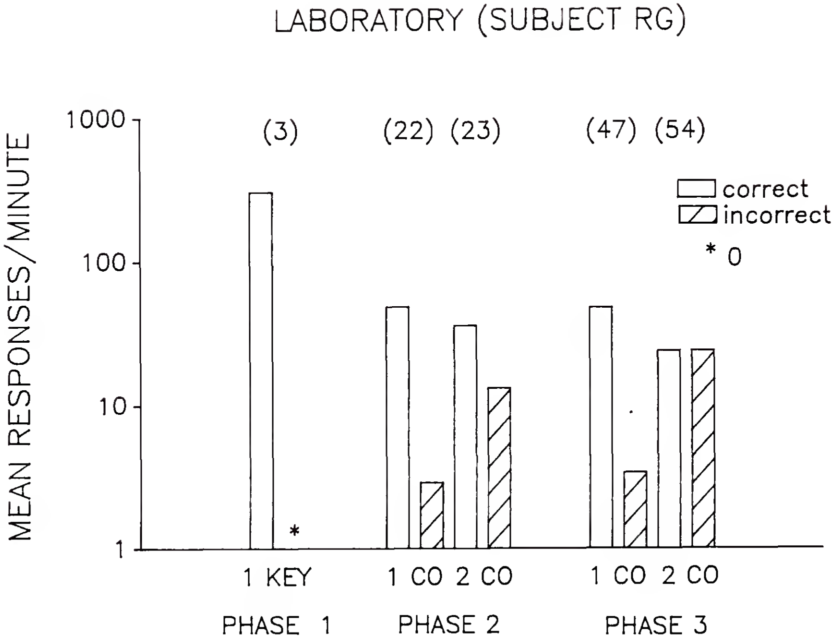
Results are discussed across all conditions with respect to each subject, one at a time, before moving to the next. The order of discussion for each subject begins with the results from laboratory training, proceeds to the non-laboratory data, presents the results of _t_ tests comparing non-laboratory performances (pre, during, and post laboratory training), and ends with a summary statement.

Subject RG

Subject RG's acquisition data for laboratory procedures are summarized in Figure 3 (specific session data are detailed in Appendix C). Bar graphs of frequency correct and incorrect are presented for each laboratory phase (and the one and two comparison procedures of Phases 2 and 3) plotted on a logarithmic y axis.

Three sessions were run in Phase 1 without errors. RG was then introduced to Phase 3, the conditional discrimination procedure, presenting two sample stimuli successively between trials. In the first session with this procedure RG did not meet the criterion (10

Figure 3. Mean responses/minute correct and incorrect in laboratory training for subject RG are presented in bar graphs with a logarithmic y axis across all three laboratory phases, and with respect to the one and two comparison procedures in Phases 2 and 3. The number of sessions/phase are in parenthesis above each pair of bars.


LABORATORY (SUBJECT RG)
MEAN RESPONSES/MINUTE
1000
100
10
1
(3)
(22) (23)
(47) (54)
correct
incorrect
* 0
1 KEY
1 CO 2 CO
1 CO 2 CO
PHASE 1
PHASE 2
PHASE 3

consecutive correct responses) to enter the two comparison component. In subsequent sessions, criteria were met during the one comparison procedure and with few exceptions errors were not made. However, within the two comparison component error frequencies remained high (approximately 18/minute), just below frequencies correct (approximately 30/minute), through session 20 without a trend (celeration X1).

Because acquisition was not evident, the procedure was changed on session 21, presenting one sample per session (Phase 2), necessitating only a simultaneous discrimination between comparison stimuli. RG rapidly met the acquisition criteria for this matching-to-sample procedure for seven stimuli, and on the 45th session a return to the successive discrimination procedure was initiated.

RG met the acquisition criterion (10 consecutive correct responses for 3 consecutive sessions) for an identity conditional discrimination with two sample stimuli (5 & 6) within 5 sessions. However, despite a number of manipulations, including adjustments in the inter-trial interval (ITI) and time out (TO) parameters (from 1.5 to 15 seconds and from 2 to 60 seconds, respectively), changes in the schedule parameters of food presentation for correct responses (from an FR 1 to an FR 2, 3, 4, and 5), varying the criterion for entrance into the 2 comparison component (between 1 and 5 consecutive correct responses), and the manual change of stimulus positions within each trial (begun on the 56th session), RG did not meet the acquisition criterion for any more stimulus pairs. The phase change of manually switching stimulus positions was initiated because, although the relation between samples and comparison stimuli did not appear to exert control over his behavior, RG obtained frequent reinforcement by apparently learning some of the hard-wired sequences of correct comparison stimulus positions. Changing these positions manually, eliminated this source of control. By the second session with this procedure the relation between correct and incorrect presses had reversed, there were more incorrect than correct responses. This reversal continued throughout the remainder of laboratory training, a step down (divide 2) from an average of 30 to an average of 15 correct responses per minute. However, the relation between identical sample and comparison stimuli did not ever exert control and, because acquisition did not occur, laboratory training was discontinued after the 83rd session.

RG's non-laboratory data (pre, during, and post laboratory) are presented in Figures 4, 5, and 6 (specific session data are detailed in Appendix C). Mean latencies correct and incorrect per session are plotted on a logarithmic y axis across all four procedures. With few exceptions, RG's performance was perfect (no errors) on the

Figure 4. Non-laboratory data for subject RG before the implementation of laboratory training procedures (pre-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.

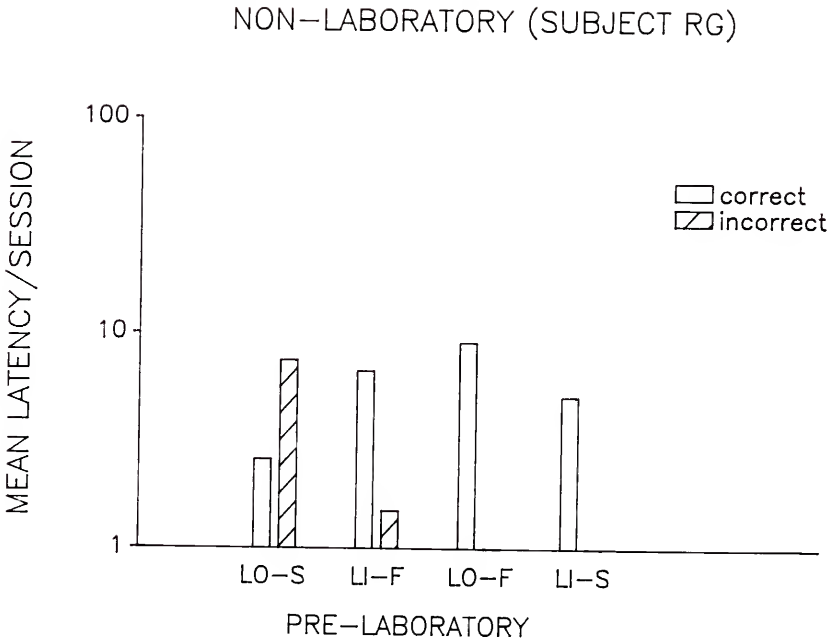

NON-LABORATORY (SUBJECT RG)
MEAN LATENCY/SESSION
100
10
1
correct
incorrect
LO-S
LI-F
LO-F
LI-S
PRE-LABORATORY

Figure 5. Non-laboratory data for subject RG collected during the implementation of laboratory training procedures (during-laboratory) are presented in bar graphs with a logarithmic y axis, separated into the corresponding laboratory phases. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure. The labels A, B, C, and D correspond to the Look-Say, Listen-Find, Look-Find, and Listen-Say procedures, respectively.

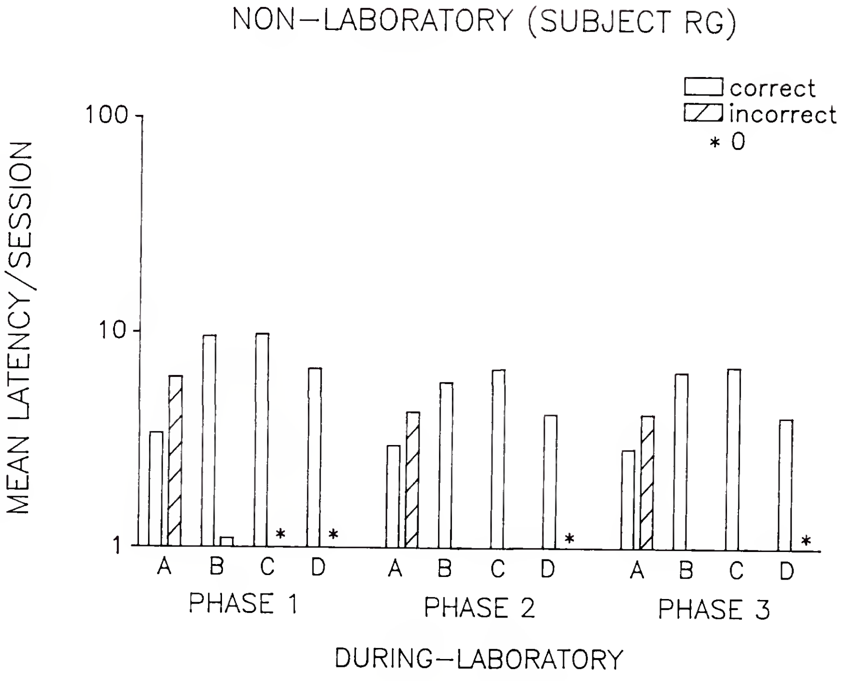
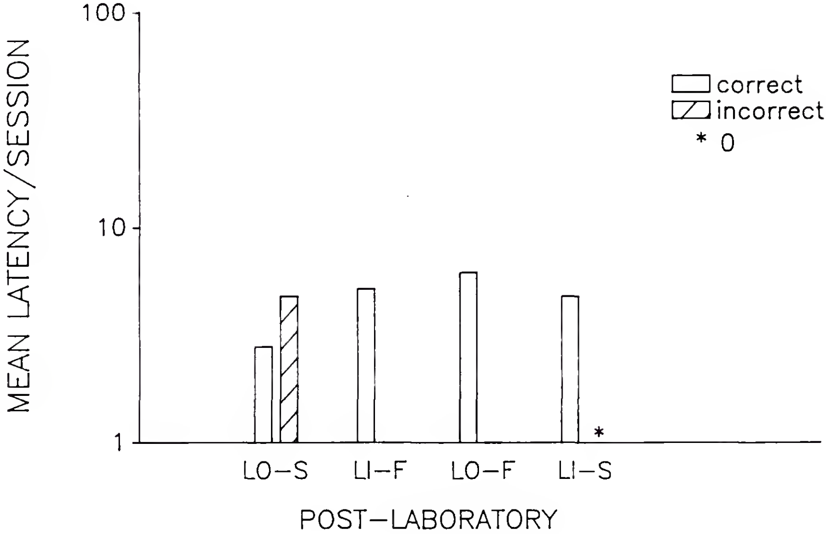

NON–LABORATORY (SUBJECT RG)
correct
incorrect
* 0
MEAN LATENCY/SESSION
100
10
1
A
B
C
D
A
B
C
D
A
B
C
D
PHASE 1
PHASE 2
PHASE 3
DURING–LABORATORY

Figure 6. Non-laboratory data for subject RG after the implementation of laboratory training procedures (post-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.

NON–LABORATORY (SUBJECT RG)



non-laboratory Listen-Say and Look-Find procedures. On the Look-Find procedure cumulative latencies incorrect were zero on all but 7 sessions, and cumulative latencies correct ranged from 4 to 20 seconds, averaging about 7 seconds. On the Listen-Say procedure cumulative latencies incorrect were zero for all but one session, and cumulative latencies correct ranged from 4 to 16 seconds, averaging about 4.5 seconds.

During the Listen-Find procedure incorrect responses were made on only 43 of the 177 sessions. Generally, once the label of a picture was stated, RG was able to point to that picture. Overall, there appears to have been no change throughout his Listen-Find baseline performance. Cumulative latencies correct ranged from 1.4 to 15 seconds, averaging about 7 seconds. Cumulative latencies incorrect ranged from zero to 13 seconds, averaging less than 2 seconds. There appears to have been no trend (celeration X1) for either correct or incorrect latencies.

Generally, on the Look-Say procedure a large proportion of RG's responses were incorrect and therefore, cumulative latencies correct were initially shorter than latencies incorrect. Thirteen sessions after the introduction of the laboratory programs the data indicate the beginning of a change in this relationship. At this point a pattern began to emerge where RG generally obtained zero corrects during one assessment and then zero incorrect on the next three. Because the criterion for completion of a picture was three consecutive correct assessments (assessment or re-assessment) across all four procedures, four new pictures were regularly introduced every fourth assessment. This pattern becomes less obvious beginning on session 21, briefly re-emerges again during sessions 40, 41, and 42, and then becomes consistently evident after session 52. Overall, cumulative latencies correct ranged from zero to 9 seconds, averaging about 2.5 seconds. Cumulative latencies incorrect ranged from zero to 15 seconds, averaging about 3.5 seconds.

The acquisition of non-laboratory successive stimulus pairs in terms of mean trials to acquisition as a function of blocks of tenths within each condition (Pre, During, and Post Laboratory) is presented in Figure 7. Prior to the introduction of the laboratory programs (pre-laboratory), 40 stimulus pairs were acquired and trials to acquisition ranged from 4 to 14 with a mean of 6.8 and a SD of 2.6. During the laboratory program, 122 stimulus pairs were acquired, trials to acquisition ranged from 4 to 12 with a mean of 5.6 and SD of 1.9. After the end of the laboratory program (post-laboratory), 99 stimulus pairs were acquired, trials to acquisition ranged from 4 to 7 with a mean of 4.4 and SD of 0.8.

A t test comparing pre-laboratory to during laboratory performance (see Table 2) indicates a significant decrease

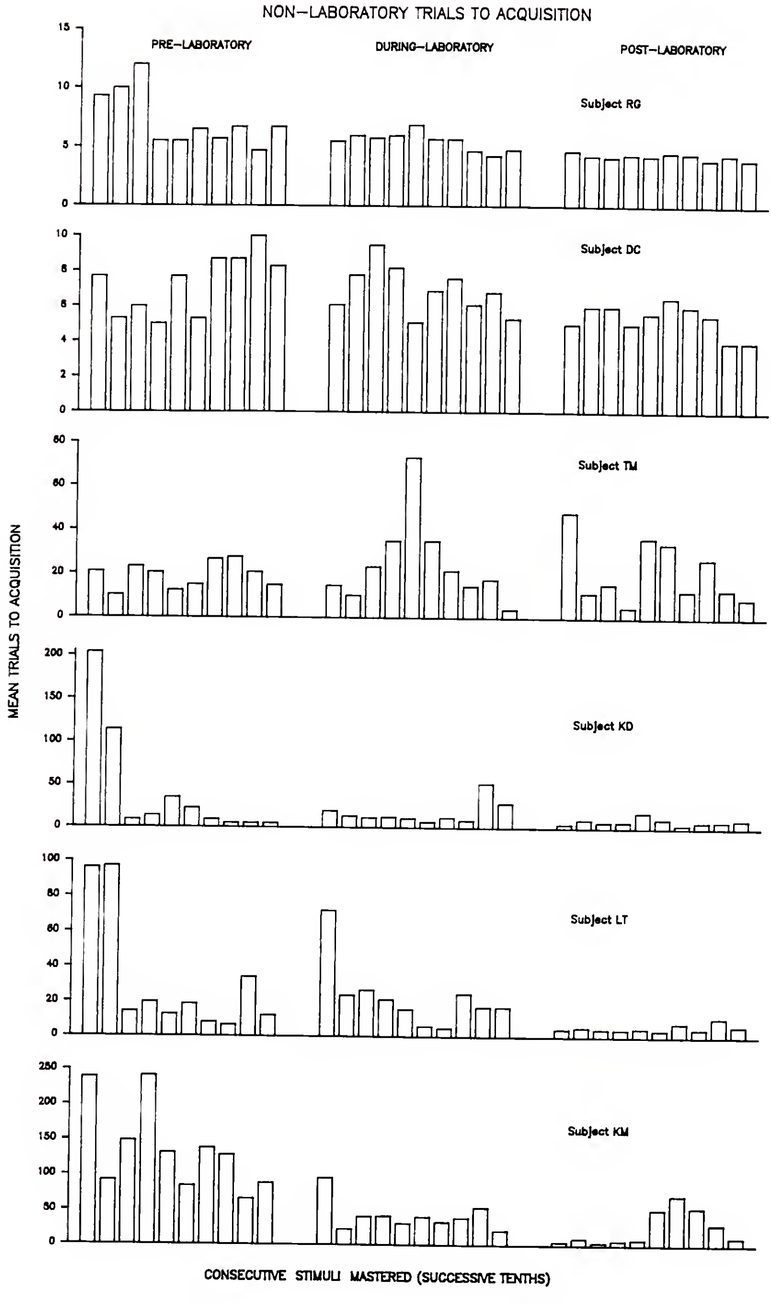
Table 2

Statistical Analyses (t test) Between Non-Laboratory Conditions

SUBJECT	STAT	PRE		DURING		POST
RG	Mean	6.8		5.6		4.4
	SD	2.6		1.9		0.8
	t test		(3.2)** (DF=160)		(6.1)** (DF=219)	
DC	Mean	7.2		7.0		5.3
	SD	3.7		5.2		2.0
	t test		(0.1) (DF=136)		(2.1)* (DF=149)	
TM	Mean	19.5		23.1		20.6
	SD	14.4		20.7		18.5
	t test		(-0.8) (DF=79)		(0.4) (DF=42)	
KD	Mean	47.6		13.6		8.9
	SD	83.5		11.7		8.8
	t test		(2.6)** (DF=65)		(1.8)* (DF=66)	
LT	Mean	45.8		16.9		6.2
	SD	72.2		20.0		3.5
	t test		(2.6)** (DF=69)		(2.8)** (DF=75)	
KM	Mean	131.3		36.1		28.6
	SD	61.4		31.3		29.1
	t test		(5.8)** (DF=30)		(0.8) (DF=36)	

* $p < .05$
** $p < .01$

Figure 7. Mean trials to acquisition of consecutive non-laboratory stimuli in successive tenths. Data are presented for all subjects across all conditions (pre, during, and post-laboratory training). Intervals on the y axis vary with respect to each subject.


NON-LABORATORY TRIALS TO ACQUISITION
PRE-LABORATORY
DURING-LABORATORY
POST-LABORATORY
Subject RG
Subject DC
Subject TM
Subject KD
Subject LT
Subject KM
MEAN TRIALS TO ACQUISITION
CONSECUTIVE STIMULI MASTERED (SUCCESSIVE TENTHS)

in trials to acquisition ($p < .01$). This decreasing trend in trials to acquisition continued, as indicated by a similar comparison of non-laboratory procedures during and after (post) laboratory training ($p < .01$).

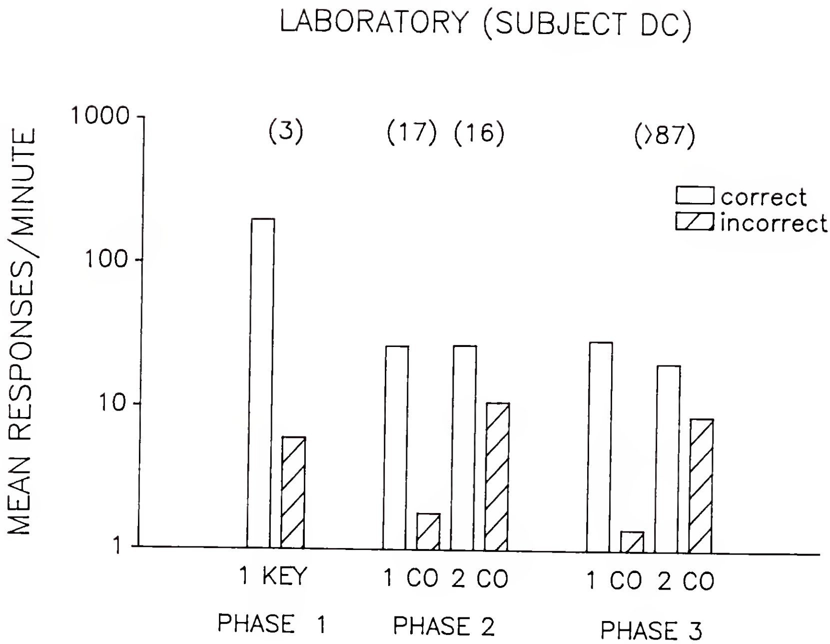
Acquisition with respect to the experimenter arranged contingencies in the laboratory occurred primarily between sessions 21 and 49. This could not be related to the baseline changes in cumulative latencies occurring during sessions 13 through 20, although it may have contributed to the changes occurring from session 40 through 42, and beyond session 52. Significant reductions in the trials to acquisition of baseline stimuli ocurred upon the introduction of laboratory training and continued after laboratory training was terminated. Although the data are inconclusive, this may have been the result of continued baseline training, rather than the result of laboratory training.

Subject DC

Subject DC's acquisition data for laboratory procedures are summarized in Figure 8 (specific session data are detailed in Appendix D).

In Phase 1 (one key) frequency correct remained high relative to frequency incorrect, DC made no errors after the first session, and she was introduced to Phase 3 (identity matching) in the fourth session. DC did not meet the criterion in this Phase (10 consecutive correct

Figure 8. Mean responses/minute correct and incorrect in laboratory training for subject DC are presented in bar graphs with a logarithmic y axis across all three laboratory phases, and with respect to the one and two comparison procedures in Phases 2 and 3. The number of sessions/phase are in parenthesis above each pair of bars.


LABORATORY (SUBJECT DC)
MEAN RESPONSES/MINUTE
1000
100
10
1
(3)
(17) (16)
(>87)
correct
incorrect
1 KEY
1 CO 2 CO
1 CO 2 CO
PHASE 1
PHASE 2
PHASE 3

responses) to enter the two comparison procedure until the second session, but did meet criterion in all subsequent sessions. However, stimulus control with respect to matching a comparison to sample stimulus was not apparent after 14 sessions, and DC was switched to the simpler Phase 2 (one sample per session).

In Phase 2 DC rapidly met criterion (10 consecutive correct responses in the two comparison condition) with 8 stimuli (in 17 sessions). As a result she was switched back to Phase 3. During this second contact with Phase 3, DC met the acquisition criterion for 6 stimulus pairs after 72 sessions.

DC's non-laboratory data (pre, during, and post laboratory) are presented in Figures 9, 10, and 11 (specific session data are detailed in Appendix D). Mean latencies correct and incorrect per session are plotted on a logarithmic y axis across all four procedures. She had little difficulty with either the Look-Find or Listen-Say procedures, latencies correct were proportionately much higher than latencies incorrect. In all 177 sessions only 3 errors were ever made in the Look-Find procedure and only two were made in Listen-Say.

Although acquisition was rapid, mean latency incorrect per session on the Look-Say procedure was longer than mean latency correct. Frequently, DC did not emit a response on this procedure, apparently when the visual stimulus exerted

Figure 9. Non-laboratory data for subject DC before the implementation of laboratory training procedures (pre-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.

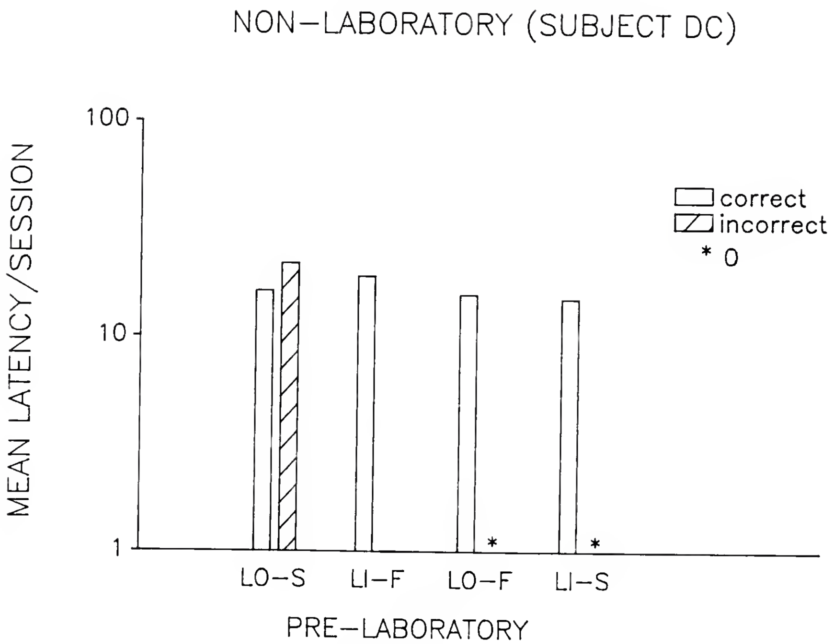

NON-LABORATORY (SUBJECT DC)
MEAN LATENCY/SESSION
100
10
1
correct
incorrect
* 0
*
*
LO-S
LI-F
LO-F
LI-S
PRE-LABORATORY

Figure 10. Non-laboratory data for subject DC collected during the implementation of laboratory training procedures (during-laboratory) are presented in bar graphs with a logarithmic y axis, separated into the corresponding laboratory phases. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure. The labels A, B, C, and D correspond to the Look-Say, Listen-Find, Look-Find, and Listen-Say procedures, respectively.

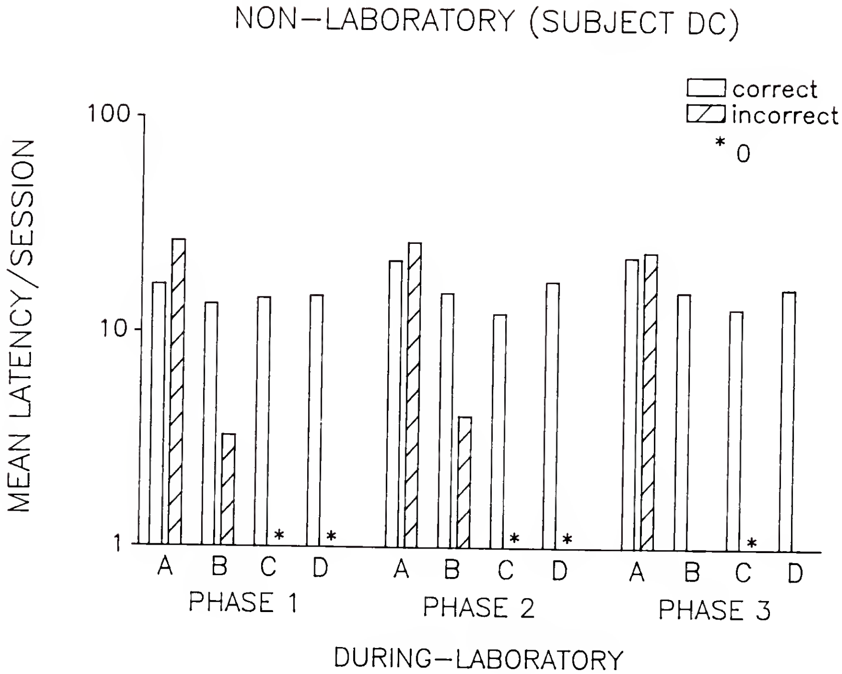
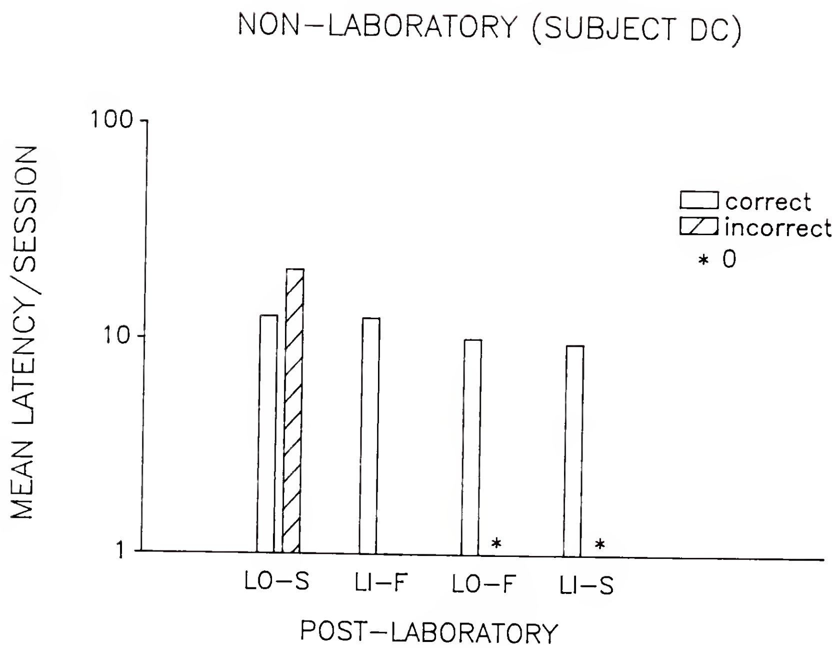

NON–LABORATORY (SUBJECT DC)
correct
incorrect
* 0
100
10
1
MEAN LATENCY/SESSION
A B C D
PHASE 1
A B C D
PHASE 2
A B C D
PHASE 3
DURING–LABORATORY

Figure 11. Non-laboratory data for subject DC after the implementation of laboratory training procedures (post-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.


NON-LABORATORY (SUBJECT DC)
100
10
1
MEAN LATENCY/SESSION
correct
incorrect
* 0
*
*
LO-S
LI-F
LO-F
LI-S
POST-LABORATORY

little control for a "correct" response. An incorrect response was recorded if no response occurred within ten seconds.

From the beginning to end of the 177 non-laboratory sessions, DC's responses on Look-Say varied greatly from day to day, particularly with respect to latencies correct. The extremes of 0 correct one day and 0 incorrect the next were not unusual, although 0 correct occurred more often. This pattern can be attributed primarily to DC's high rate of acquisition, which resulted in the frequent introduction of groups of new stimuli (often 4).

The frequency of errors on the Listen-Find procedure initially increased with the introduction of laboratory training and continued for 76 sessions. Error frequency decreased and the pattern exemplified by the pre an post laboratory Listen-Find procedures was resumed within the last 69 laboratory sessions.

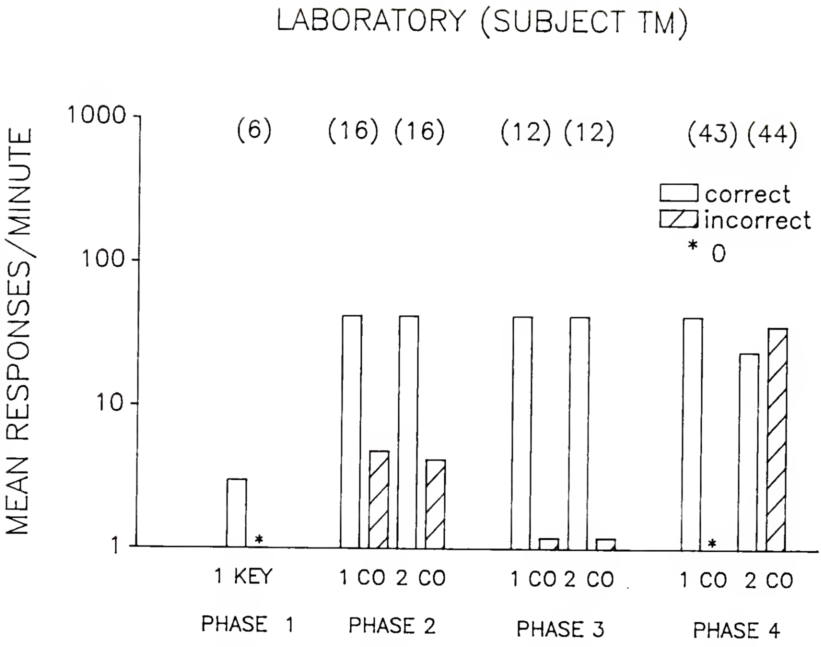
The acquisition of non-laboratory successive stimulus pairs in terms of mean trials to acquisition as a function of blocks of tenths within each condition (Pre, During, and Post Laboratory) is presented in Figure 7. Prior to the introduction of the laboratory programs (pre-laboratory), 31 stimulus pairs were acquired and trials to acquisition ranged from 4 to 16 with a mean of 7.2 and a SD of 3.7. During the laboratory program, 107 stimulus pairs were acquired and trials to acquisition ranged from 4 to 38 with a mean of 7 and SD of 5.2. After the end of the laboratory program (post-laboratory), 44 stimulus pairs were acquired and trials to acquisition ranged from 4 to 12 with a mean of 5.3 and SD of 2.0.

A _t_ test comparing non-laboratory performance (see Table 2) before and during laboratory training did not indicate a significant difference in trials to acquisition. However, a comparison of non-laboratory performance during and after (post) laboratory training did indicate a significant decrease in trials to acquisition ($p < .05$). Listen-Find performance deteriorated during laboratory training until the end of Phase 2 and returned to pre-laboratory levels only after laboratory training was discontinued. It appears that laboratory training, particularly during Phase 1, first contact with Phase 3, and the Phase 2 procedures disrupted acquisition during non-laboratory training, but subsequently overall acquisition was improved.

Subject TM

Subject TM's acquisition data for laboratory procedures are summarized in Figure 12 (specific session data are detailed in Appendix E). Bar graphs of frequency correct and incorrect are presented for each laboratory phase (and the one and two comparison procedures of Phases 2, 3, and 4) plotted on a logarithmic y axis.

Figure 12. Mean responses/minute correct and incorrect in laboratory training for subject TM are presented in bar graphs with a logarithmic y axis across all four laboratory phases, and with respect to the one and two comparison procedures in Phases 2, 3, and 4. The number of sessions/phase are in parenthesis above each pair of bars.


LABORATORY (SUBJECT TM)
MEAN RESPONSES/MINUTE
1000
100
10
1
(6)
(16) (16)
(12) (12)
(43) (44)
correct
incorrect
* 0
1 KEY
1 CO 2 CO
1 CO 2 CO
1 CO 2 CO
PHASE 1
PHASE 2
PHASE 3
PHASE 4

Three sessions were run in Phase 1 (one key condition) without errors. TM was then introduced to Phase 2 presenting one sample stimulus between trials. In the first five sessions, although performance with one comparison rapidly improved (celeration = X200), error frequency remained significantly higher than correct frequency, and TM was switched back to the Phase 1 procedure for three more sessions. Upon return to Phase 2, TM's performance significantly improved and criterion was met for 8 stimuli in 15 sessions.

Upon introduction to Phase 3, TM met the acquisition criterion (10 consecutive correct responses for 3 consecutive sessions) for identity conditional discriminations with four stimulus pairs in 14 sessions.

TM was then introduced to Phase 4 (the non-identity conditional discrimination procedure). He met the acquisition criterion for six stimulus pairs in 44 sessions.

TM's non-laboratory data (pre, during, and post laboratory) are presented in Figures 13, 14, and 15 (specific session data are detailed in Appendix E). Mean latencies correct and incorrect per session are plotted on a logarithmic y axis across all four procedures. With one exception, TM's performance was perfect (no errors) on the non-laboratory Listen-Say and Look-Find procedures. On the

Figure 13. Non-laboratory data for subject TM before the implementation of laboratory training procedures (pre-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.

NON-LABORATORY (SUBJECT TM)

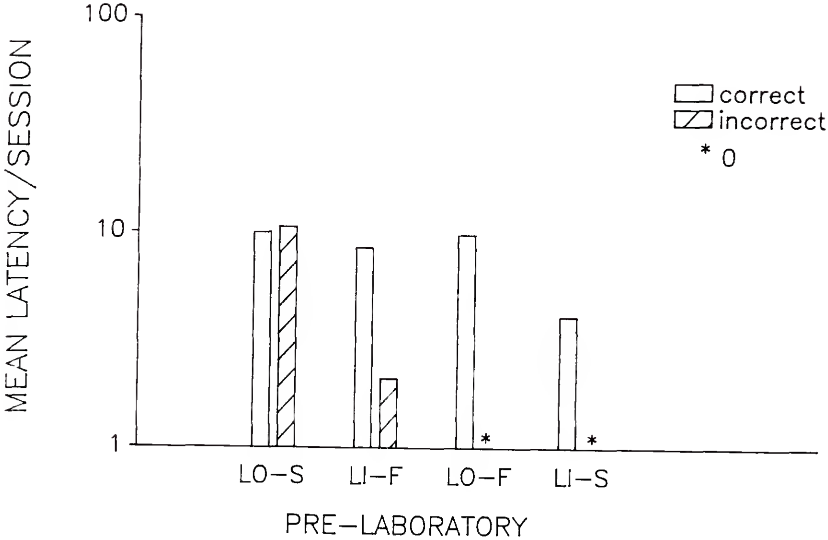


Figure 14. Non-laboratory data for subject TM collected during the implementation of laboratory training procedures (during-laboratory) are presented in bar graphs with a logarithmic y axis, separated into the corresponding laboratory phases. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure. The labels A, B, C, and D correspond to the Look-Say, Listen-Find, Look-Find, and Listen-Say procedures, respectively.

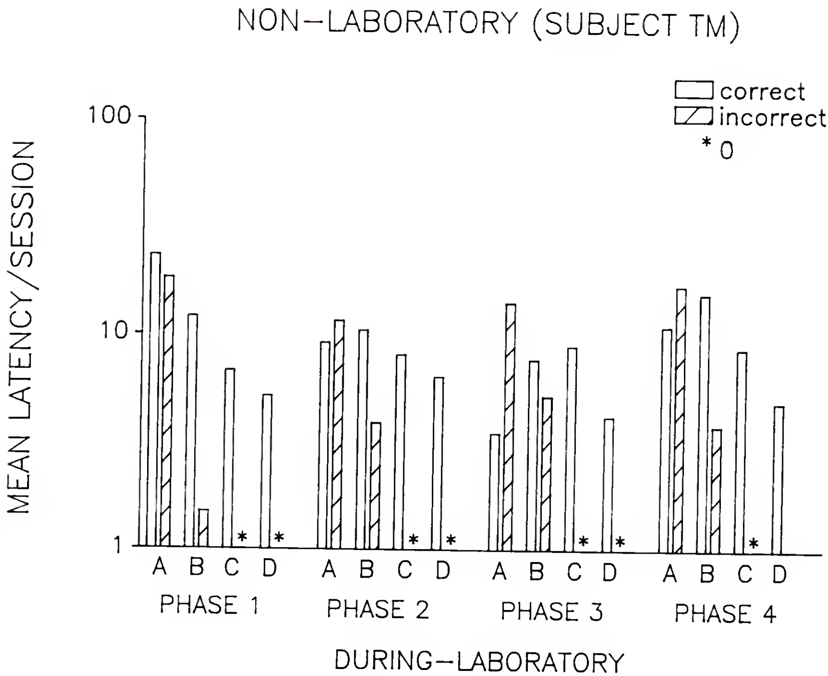
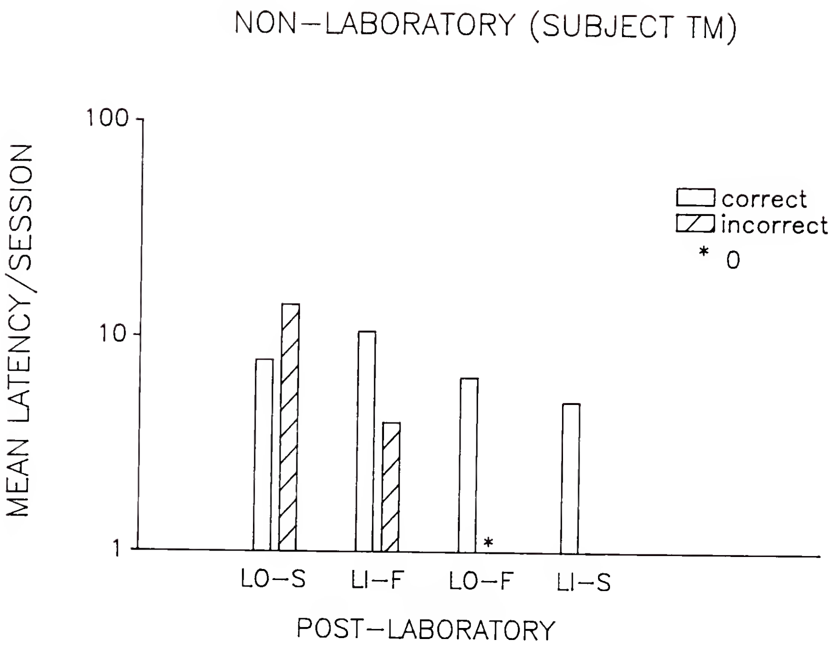

NON-LABORATORY (SUBJECT TM)
correct
incorrect
* 0
100
10
1
MEAN LATENCY/SESSION
A B C D
PHASE 1
A B C D
PHASE 2
A B C D
PHASE 3
A B C D
PHASE 4
DURING-LABORATORY

Figure 15. Non-laboratory data for subject TM after the implementation of laboratory training procedures (post-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.


NON-LABORATORY (SUBJECT TM)
MEAN LATENCY/SESSION
100
10
1
correct
incorrect
* 0
LO-S
LI-F
LO-F
LI-S
POST-LABORATORY

Look-Find procedure cumulative latencies incorrect were always zero, and cumulative latencies correct ranged from 3.5 to 27 seconds, averaging about 7 seconds. On the Listen-Say procedure cumulative latencies incorrect were zero for all but one session, and cumulative latencies correct ranged from 1.2 to 55 seconds, averaging about 4.5 seconds.

On the Listen-Find procedure TM's performance remained variable throughout training. Although latencies incorrect were more often zero than latencies correct, frequent crossovers, apparently unrelated to laboratory training, occurred throughout.

Generally, on the Look-Say procedure an equal proportion of TM's responses were correct and incorrect, with the most significant difference between mean correct and incorrect latencies occurring during Phase 3 of the laboratory training. During this Phase, mean latency incorrect was 14.1 and mean correct was 3.5. This same relationship was observed during the laboratory Phase 4 (11 correct and 17 incorrect) and in post laboratory sessions (7.1 correct and 13.5 incorrect). Overall, cumulative latencies correct ranged from zero to 85 seconds, averaging about 9 seconds. Cumulative latencies incorrect ranged from zero to 65 seconds, averaging about 12 seconds.

The acquisition of non-laboratory successive stimulus pairs in terms of mean trials to acquisition as a function of blocks of tenths within each condition (Pre, During, and Post Laboratory) is presented in Figure 7. Prior to the introduction of the laboratory programs (pre-laboratory), 58 stimulus pairs were acquired and trials to acquisition ranged from 4 to 70 with a mean of 19.5 and a SD of 15.4. During the laboratory program, 23 stimulus pairs were acquired, trials to acquisition ranged from 4 to 73 with a mean of 23.1 and SD of 20.7. After the end of the laboratory program (post-laboratory), 21 stimulus pairs were acquired, trials to acquisition ranged from 4 to 69 with a mean of 20.6 and SD of 18.5.

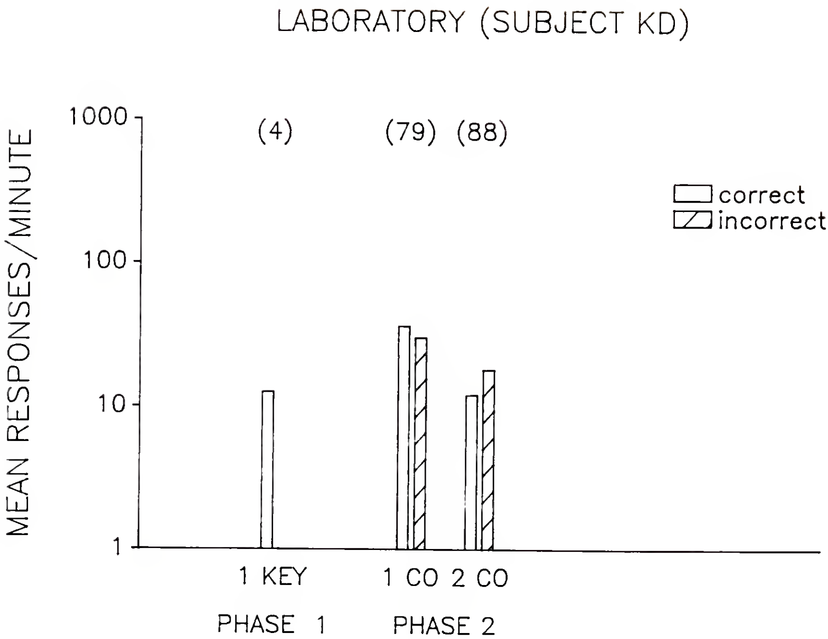
A t test comparing trials to acquisition from pre-laboratory to during laboratory performance, and from during to post laboratory did not indicate significance (see Table 2).

Subject KD

Subject KD's acquisition data for laboratory procedures are summarized in Figure 16 (specific session data are detailed in Appendix F). Bar graphs of frequency correct and incorrect are presented for each laboratory phase (and the one and two comparison procedures of Phase 2), plotted on a logarithmic y axis.

Four sessions were run in Phase 1 (one key condition) during which the inter-trial interval was gradually increased from 5 to 15 seconds and at the end of which virtually no errors were made. KD was then introduced to

Figure 16. Mean responses/minute correct and incorrect in laboratory training for subject KD are presented in bar graphs with a logarithmic y axis across both laboratory phases, and with respect to the one and two comparison procedures in Phase 2. The number of sessions/phase are in parenthesis above each pair of bars.


LABORATORY (SUBJECT KD)
MEAN RESPONSES/MINUTE
1000
100
10
1
(4)
(79)
(88)
correct
incorrect
1 KEY
1 CO
2 CO
PHASE 1
PHASE 2

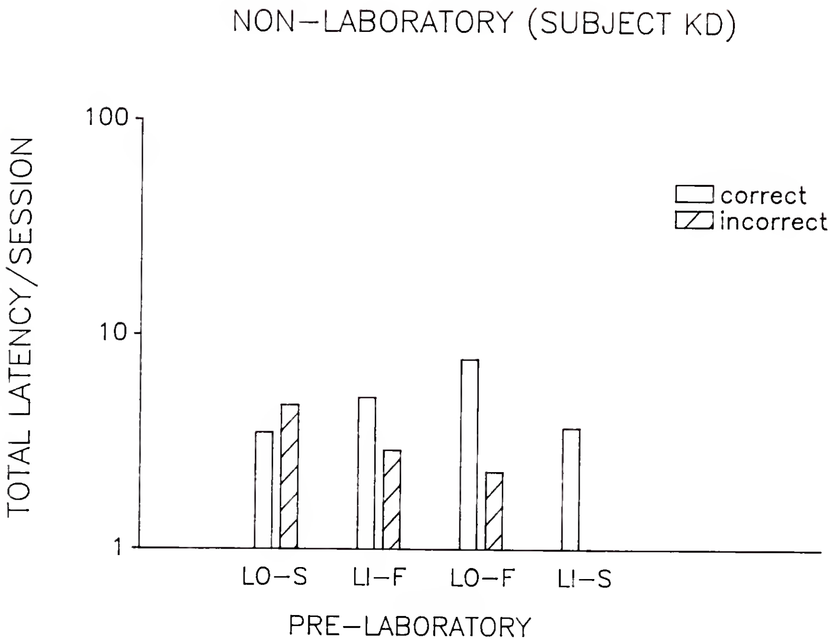
Phase 2, the matching procedure, requiring only a simultaneous simple discrimination. In the first and all subsequent sessions the criterion (10 consecutive correct responses) was met to move from the one comparison into the two comparison procedure. Performance on the one comparison procedure remained accurate throughout training, with frequencies incorrect exceeding frequencies correct during only one session. However, on the two comparison procedure, despite numerous procedural manipulations, KD's performance was poor and did not improve throughout training. Frequencies incorrect were almost always higher than frequencies correct.

Manipulations that were attempted to improve performance included increasing the inter-trial interval from 5 to 15 seconds, adjusting the time out parameter between 5 and 60 seconds, varying edible reinforcements (determined effective in non-laboratory training), coloring the correct stimulus red, and on several occasions the experimenter entered the experimental chamber and provided prompts and social reinforcement (including praise, clapping, and backrubbing) for correct responses and social disapproval (e.g., "No, KD that's not right!") for incorrect responses. After 88 sessions without any indication of acquisition (celeration for correct and incorrect responses was X1), laboratory training was discontinued.

KD's non-laboratory data (pre, during, and post laboratory) are presented in Figures 17, 18, and 19 (specific session data are detailed in Appendix F). Mean latencies correct and incorrect per session are plotted for all 343 sessions on a logarithmic y axis across all four procedures. KD made errors on the Listen-Say procedure within 9 sessions and cumulative latencies correct varied from 0 to 17, averaging about 4.5 seconds. On the Look-Find procedure the ratio of incorrect to correct cumulative latencies was relatively high for the first 82 sessions and decreased over the last 84 sessions before the introduction of laboratory training. In the pre-laboratory condition mean total latency correct was 3.7 and mean total latency incorrect was 2.3. During laboratory training mean total latencies correct remained significantly higher than latencies incorrect across both phases (Phase 1: correct = 11.5 seconds, incorrect = 0.4 seconds; Phase 2: correct = 8.2, incorrect = 0.67). This relationship gravitated toward the pre-laboratory ratio during post-laboratory training as the total mean latency correct was 7.6 seconds while the corresponding latency incorrect was 1.2 seconds.

A similar relationship was demonstrated on the Listen-Find procedure. The largest proportion of incorrect responses occurred before the introduction of laboratory training, and although improvement was evident during laboratory training, when training was discontinued the

Figure 17. Non-laboratory data for subject KD before the implementation of laboratory training procedures (pre-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.



NON-LABORATORY (SUBJECT KD)
TOTAL LATENCY/SESSION
100
10
1
correct
incorrect
LO-S
LI-F
LO-F
LI-S
PRE-LABORATORY

Figure 18. Non-laboratory data for subject KD collected during the implementation of laboratory training procedures (during-laboratory) are presented in bar graphs with a logarithmic y axis, separated into the corresponding laboratory phases. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure. The labels A, B, C, and D correspond to the Look-Say, Listen-Find, Look-Find, and Listen-Say procedures, respectively.

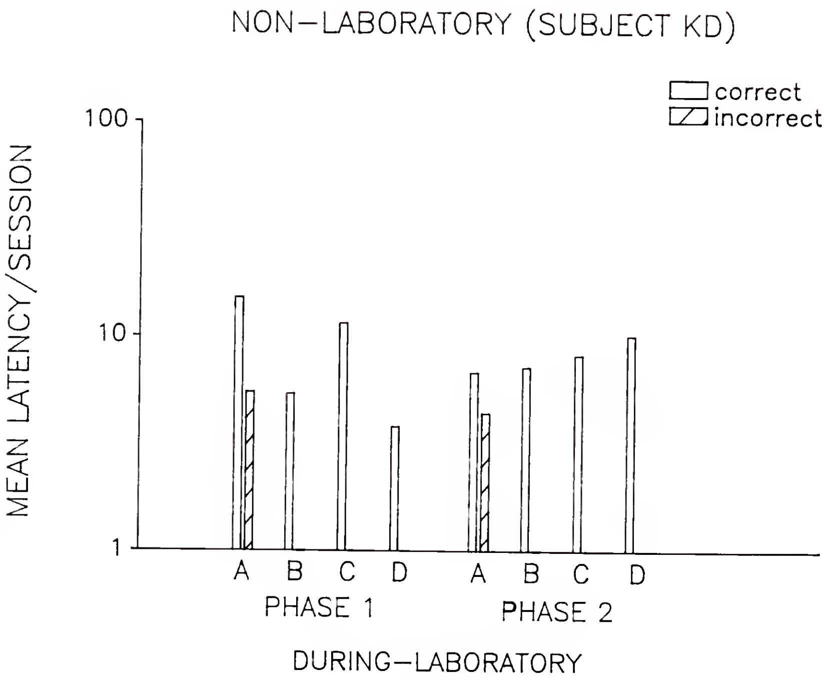
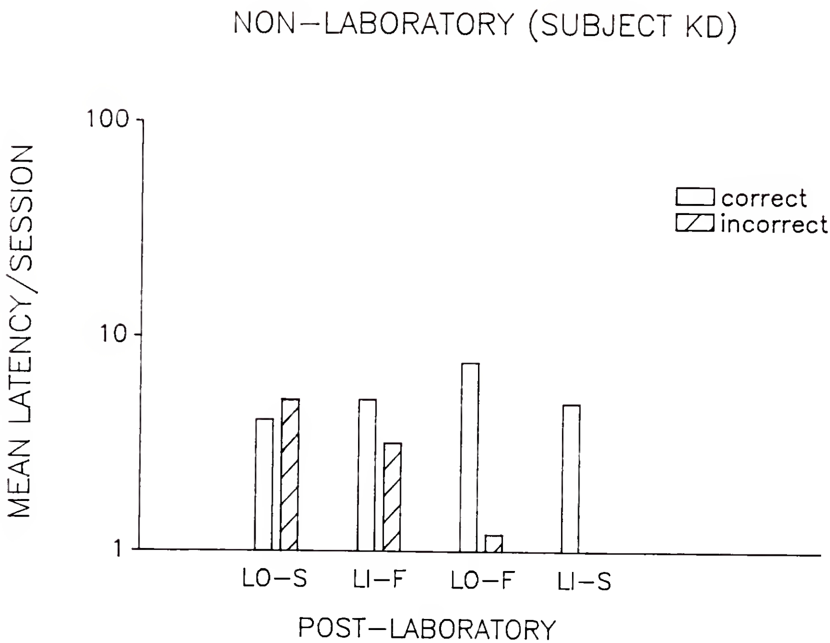

NON–LABORATORY (SUBJECT KD)
correct
incorrect
MEAN LATENCY/SESSION
100
10
1
A B C D
PHASE 1
A B C D
PHASE 2
DURING–LABORATORY

Figure 19. Non-laboratory data for subject KD after the implementation of laboratory training procedures (post-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.


NON-LABORATORY (SUBJECT KD)
MEAN LATENCY/SESSION
100
10
1
correct
incorrect
LO-S
LI-F
LO-F
LI-S
POST-LABORATORY

ratio approached the pre-laboratory level (pre: correct = 5.1, incorrect = 2.9; Phase 1: correct = 5.4, incorrect = 0.6; Phase 2: correct = 7.2, incorrect = 0.7; and post: correct = 5.1, incorrect = 3.2).

Generally, on the Look-Say procedure KD's performance remained poor throughout training. Except for the 3 Phase 1 sessions when mean session latency correct was 15.1 seconds and the corresponding latency incorrect was 5.5 seconds, the difference between corrects and incorrect latencies was insignificant.

The acquisition of non-laboratory successive stimulus pairs in terms of mean trials to acquisition as a function of blocks of tenths within each condition (Pre, During, and Post Laboratory) is presented in Figure 7. Prior to the introduction of the laboratory programs (pre-laboratory), 26 stimulus pairs were acquired and trials to acquisition ranged from 4 to 291 with a mean of 47.6 and a SD of 83.5. During the laboratory program, 41 stimulus pairs were acquired, trials to acquisition ranged from 4 to 84 with a mean of 13.6 and SD of 11.7. After the end of the laboratory program (post-laboratory), 27 stimulus pairs were acquired, trials to acquisition ranged from 4 to 47 with a mean of 8.9 and SD of 8.8.

A $\underline{t}$ test comparing non-laboratory performance before and during laboratory training (see Table 2) indicated a significant decrease in trials to acquisition ($p < .01$).

Furthermore, a comparison of non-laboratory performance during and after (post) laboratory training also indicated a significant reduction in trials to acquisition ($p < .05$). It appears that KD's overall improved performance may have been due to specific improvements with respect to the Listen-Find and Look-Say procedures. Furthermore, although little acquisition occurred in the laboratory, the introduction and discontinuation of laboratory training corresponds to an improvement and subsequent deterioration in non-laboratory performance.

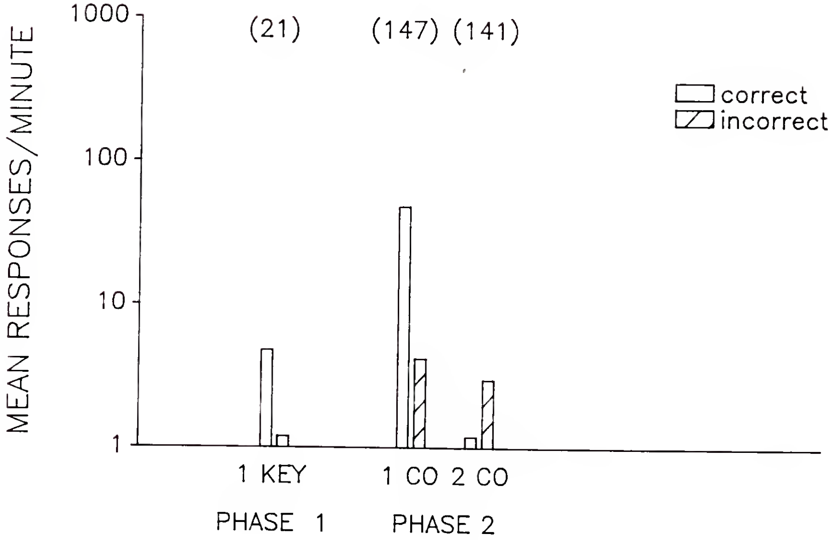
Subject LT

Subject LT's acquisition data for laboratory procedures are summarized in Figure 20 (specific session data are detailed in Appendix G). Bar graphs of frequency correct and incorrect are presented for each laboratory phase (and the one and two comparison procedures of Phase 2), plotted on a logarithmic y axis.

Twenty-one sessions were run in Phase 1 (one key condition). The first two sessions LT did not respond in any noticeable way with respect to the stimulus key or any part of the apparatus. Over the next three sessions responses to parts of the panel other than the lighted key (particularly the sonalert) were abundant, and correct responses were gradually shaped (the experimenter engaged the universal feeder with a remote switch). During the last sixteen sessions in Phase 1, correct responses

Figure 20. Mean responses/minute correct and incorrect in laboratory training for subject LT are presented in bar graphs with a logarithmic y axis across both laboratory phases, and with respect to the one and two comparison procedures in Phase 2. The number of sessions/phase are in parenthesis above each pair of bars.

LABORATORY (SUBJECT LT)



increased to frequencies greater than incorrect responses. LT was then introduced to Phase 2, the matching procedure, requiring a simultaneous simple discrimination with the same sample stimulus presented each trial.

Until the 15th session in Phase 2, LT met criterion (10 consecutive correct responses) to enter the two comparison procedure only once. Subsequently, she met this criterion on virtually every session. After 71 sessions in Phase 2, LT met the two comparison acquisition criterion for one stimulus (number 5). Another stimulus from the same set (stimulus number 6) was introduced in the next session, but LT demonstrated a significant preference for the previously correct stimulus (number 5). After eleven sessions without any indication of acquisition a stimulus from a different set (stimulus number 9) was introduced. Within three session LT met the acquisition criterion. Again, when another stimulus from the same set was introduced (stimulus number 10) a preference for the previously correct stimulus (stimulus number 9) interfered with acquisition. In an effort to punish and/or extinguish this preference, or enhance the effect of reinforcement delivery for correct responses, several manipulations were made. For example, inter-trial intervals were varied from 5 to 15 seconds, time out parameters were adjusted from 5 to 60 seconds, reinforcers were varied and delivered on ratio schedules (FR 1 to 3), training stimuli were systematically alternated from set to set across sessions, and on several occasions the experimenter entered the experimental chamber and provided prompts and social reinforcement (including praise, clapping, and backrubbing) for correct responses and social disapproval (e.g., "No, LT that's not right!") for incorrect responses. Acquisition was painfully slow but persistent, and after 147 sessions in Phase 2, criterion was met for 4 stimuli and laboratory training was discontinued.

LT's non-laboratory data (pre, during, and post laboratory) are presented in Figures 21, 22, and 23 (specific session data are detailed in Appendix G). Mean latencies correct and incorrect per session are plotted for all 310 sessions on a logarithmic y axis across all four procedures. LT made errors on the Listen-Say procedure within 9 sessions and cumulative latencies correct varied from 0 to 19, averaging about 5.1 seconds. LT had a great deal of difficulty with the Look-Find procedure for about the first 38 sessions and then her performance improved such that correct responses generally outnumbered incorrect responses.

In the pre-laboratory condition mean total latency correct was 6.3 and mean total latency incorrect was 2.3. During laboratory training mean total latency correct was approximately 6 seconds and mean total latency incorrect was approximately 1.0 seconds. After laboratory training,

Figure 21. Non-laboratory data for subject LT before the implementation of laboratory training procedures (pre-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.

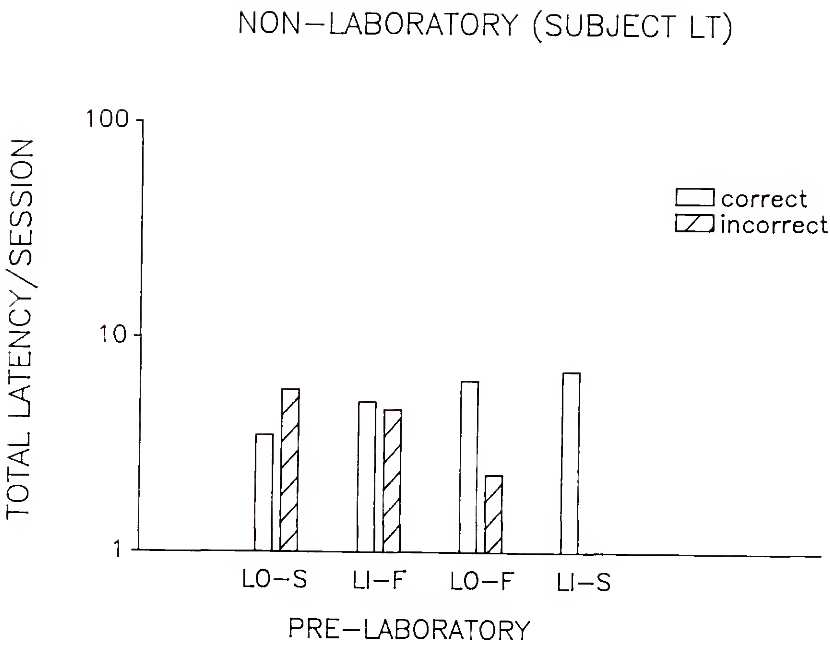
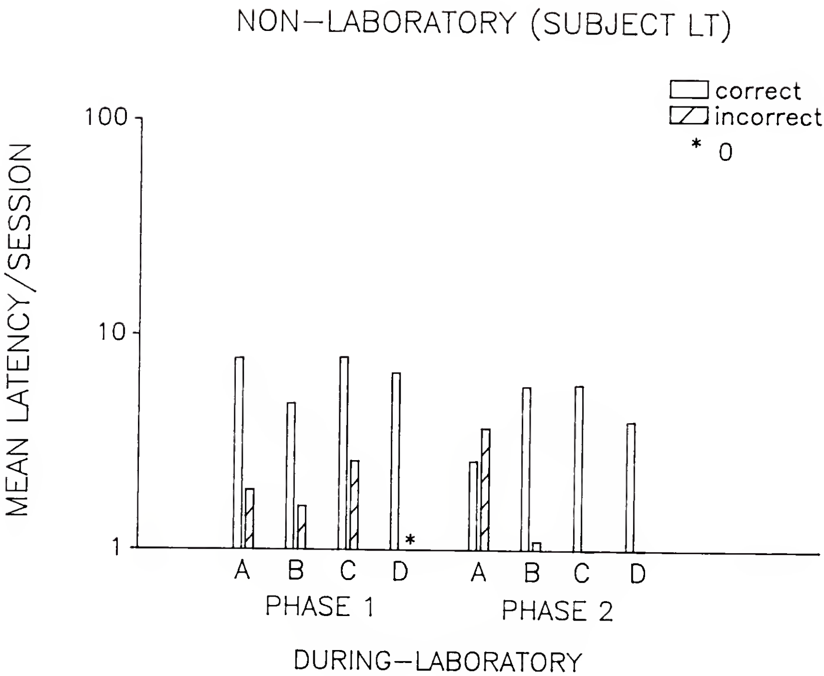
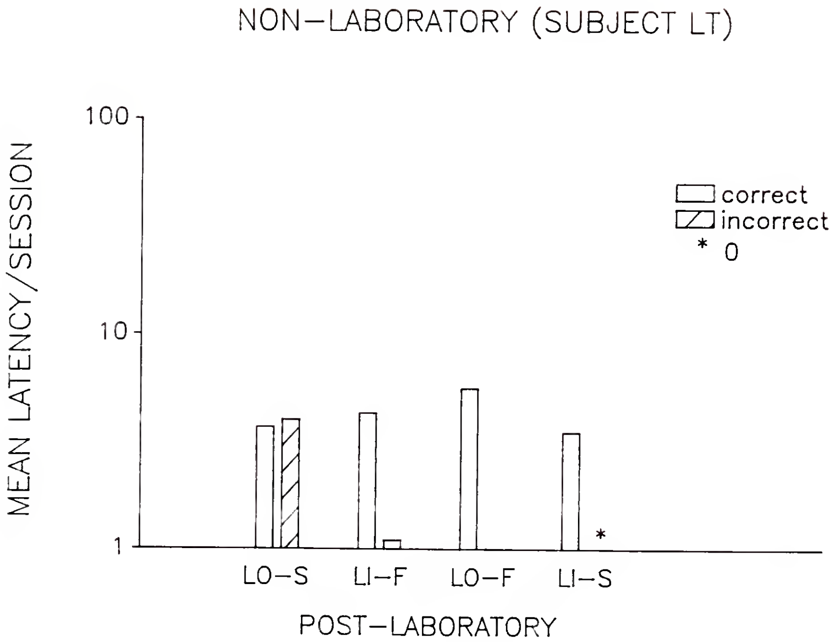

NON–LABORATORY (SUBJECT LT)
TOTAL LATENCY/SESSION
100
10
1
correct
incorrect
LO–S
LI–F
LO–F
LI–S
PRE–LABORATORY

Figure 22. Non-laboratory data for subject LT collected during the implementation of laboratory training procedures (during-laboratory) are presented in bar graphs with a logarithmic y axis, separated into the corresponding laboratory phases. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure. The labels A, B, C, and D correspond to the Look-Say, Listen-Find, Look-Find, and Listen-Say procedures, respectively.



NON–LABORATORY (SUBJECT LT)
correct
incorrect
* 0
MEAN LATENCY/SESSION
100
10
1
A B C D
PHASE 1
A B C D
PHASE 2
DURING–LABORATORY

Figure 23. Non-laboratory data for subject LT after the implementation of laboratory training procedures (post-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.



NON-LABORATORY (SUBJECT LT)
MEAN LATENCY/SESSION
100
10
1
correct
incorrect
* 0
*
LO-S
LI-F
LO-F
LI-S
POST-LABORATORY

mean latency correct was 5.6 seconds and mean latency incorrect was 0.6 seconds. The relationship between correct and incorrect responses with the Look-Find procedure remained relatively stable.

Improved non-laboratory performance on the Listen-Find and Look-Say procedures coincided with the introduction of laboratory training. On Listen-Find, the relationship between correct and incorrect responses with respect to mean total latency/session improved during Phase 1 and that improvement was maintained across Phases 2 and in the post-laboratory condition (pre: correct = 5., incorrect = 4.6; Phase 1: correct = 4.8, incorrect = 1.6; Phase 2: correct = 5.8, incorrect = 1.1; and post: correct = 4.3, incorrect = 1.1). An improvement was made on the Look-Say procedure during Phase 1, but was reversed to the pre-laboratory relationship during Phase 2 and that reversal was maintained once laboratory training was discontinued (pre: correct = 3.5, incorrect = 5.7; Phase 1: correct = 7.8, incorrect = 1.9; Phase 2: correct = 2.6, incorrect = 3.7; and post: correct = 3.7, incorrect = 4).

The acquisition of non-laboratory successive stimulus pairs in terms of mean trials to acquisition as a function of blocks of tenths within each condition (Pre, During, and Post Laboratory) is presented in Figure 7. Prior to the introduction of the laboratory programs (pre-laboratory), 22 stimulus pairs were acquired and trials to acquisition ranged from 4 to 319 with a mean of 45.8 and a SD of 72.2. During the laboratory program, 49 stimulus pairs were acquired, trials to acquisition ranged from 4 to 102 with a mean of 16.8 and SD of 20. After the end of the laboratory program (post-laboratory), 28 stimulus pairs were acquired, trials to acquisition ranged from 4 to 16 with a mean of 6.2 and SD of 3.5.

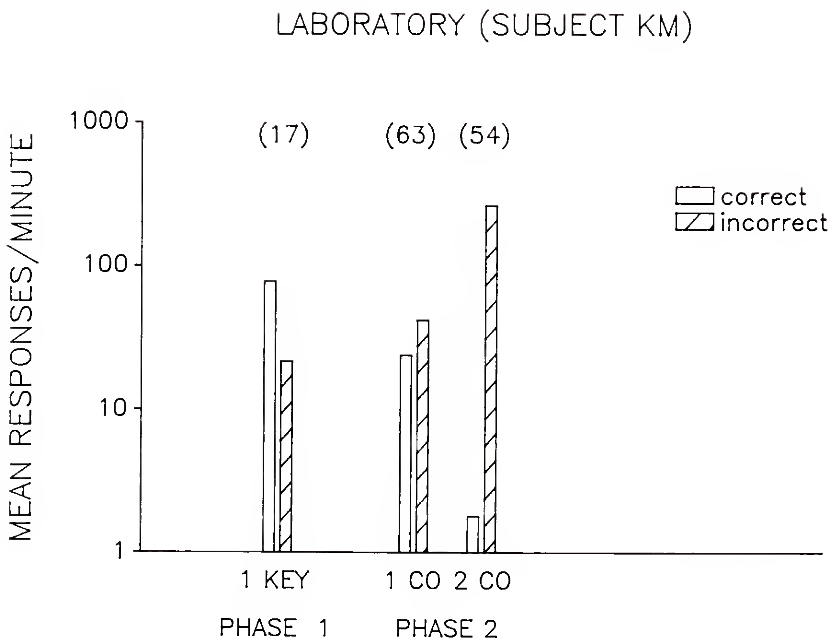
A $\underline{t}$ test comparing non-laboratory performance before and during laboratory training (see Table 2) indicated a significant decrease in trials to acquisition ($p < .01$). Furthermore, a comparison of non-laboratory performance during and after (post) laboratory training also indicated a significant reduction in trials to acquisition ($p < .01$). It appears that LT's overall improved performance may have been due to specific improvements primarily with respect to the Listen-Find procedures.

Subject KM

Subject KM's acquisition data for laboratory procedures are summarized in Figure 24 (specific session data are detailed in Appendix H). Bar graphs of frequency correct and incorrect are presented for each laboratory phase (and the one and two comparison procedures of Phase 2), plotted on a logarithmic y axis.

Seventeen sessions were run in Phase 1 (one key condition). KM's performance gradually improved across

Figure 24. Mean responses/minute correct and incorrect in laboratory training for subject KM are presented in bar graphs with a logarithmic y axis across both laboratory phases, and with respect to the one and two comparison procedures in Phase 2. The number of sessions/phase are in parenthesis above each pair of bars.


LABORATORY (SUBJECT KM)
MEAN RESPONSES/MINUTE
1000
100
10
1
(17)
(63)
(54)
correct
incorrect
1 KEY
1 CO
2 CO
PHASE 1
PHASE 2

sessions (celeration of frequencies incorrect: divide 1.9) until 61 correct and only 1 incorrect response was made in the last session. On the nineteenth session Phase 2 was introduced.

In Phase 2, KM did not meet the criterion (10 consecutive correct responses) to enter the two comparison procedure until the eleventh session. During subsequent sessions he never failed to meet that criterion. However, KM remained in Phase 2 for a total of 63 sessions and met the acquisition criterion for only two stimuli. A number of procedural manipulations were attempted to establish stimulus control. For example, inter-trial intervals were varied from 5 to 15 seconds, time out parameters were adjusted from 5 to 60 seconds, reinforcers were varied and delivered on ratio schedules (FR 1 to 3), and on several occasions the experimenter entered the experimental chamber and provided prompts and social reinforcement (including praise, clapping, and backrubbing) for correct responses and social disapproval (e.g., "No, LT that's not right!") for incorrect responses. However, only one manipulation proved effect. A red tint was added to both the training stimuli (sample and comparison) and was systematically faded over a series of four steps. Once this supplemental stimulus was introduced, criterion was met for the first stimulus in 27 sessions. The second stimulus was acquired in only four sessions and laboratory training was discontinued.

KM's non-laboratory data (pre, during, and post laboratory) are presented in Figures 25, 26, and 27 (specific session data are detailed in Appendix H). Mean latencies correct and incorrect per session are plotted for all 343 sessions on a logarithmic y axis across all four procedures.

As is evidenced in these figures, the relationships between cumulative mean latencies correct and incorrect remained stable within all four procedures across all conditions. Across all conditions, on the Listen-Say procedure mean total latency correct was 8.5 seconds and mean total latency incorrect was 0.8 seconds. On the Look-Find procedure mean total latency correct was 22.3 seconds and mean total latency incorrect was 6.4 seconds. Mean total latency correct on the Listen-Find procedure was 8.8 seconds and mean total latency incorrect was 3.0 seconds. Finally, on the Look-Say procedure mean total latency correct was 8.5 seconds and mean total latency incorrect was 5.5 seconds.

The acquisition of non-laboratory successive stimulus pairs in terms of mean trials to acquisition as a function of blocks of tenths within each condition (Pre, During, and Post Laboratory) is presented in Figure 7. Prior to the introduction of the laboratory programs (pre-laboratory),

Figure 25. Non-laboratory data for subject KM before the implementation of laboratory training procedures (pre-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.

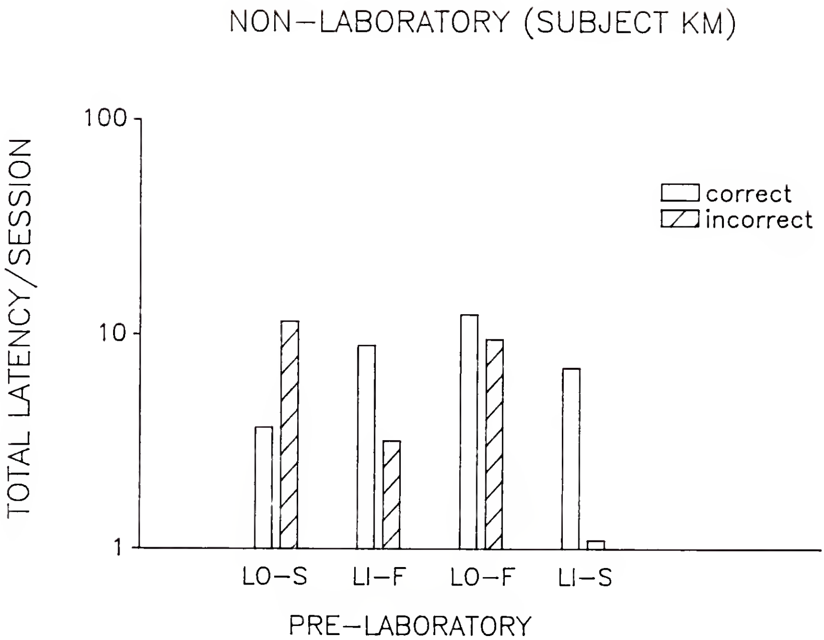

NON-LABORATORY (SUBJECT KM)
TOTAL LATENCY/SESSION
100
10
1
correct
incorrect
LO-S
LI-F
LO-F
LI-S
PRE-LABORATORY

Figure 26. Non-laboratory data for subject KM collected during the implementation of laboratory training procedures (during-laboratory) are presented in bar graphs with a logarithmic y axis, separated into the corresponding laboratory phases. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure. The labels A, B, C, and D correspond to the Look-Say, Listen-Find, Look-Find, and Listen-Say procedures, respectively.

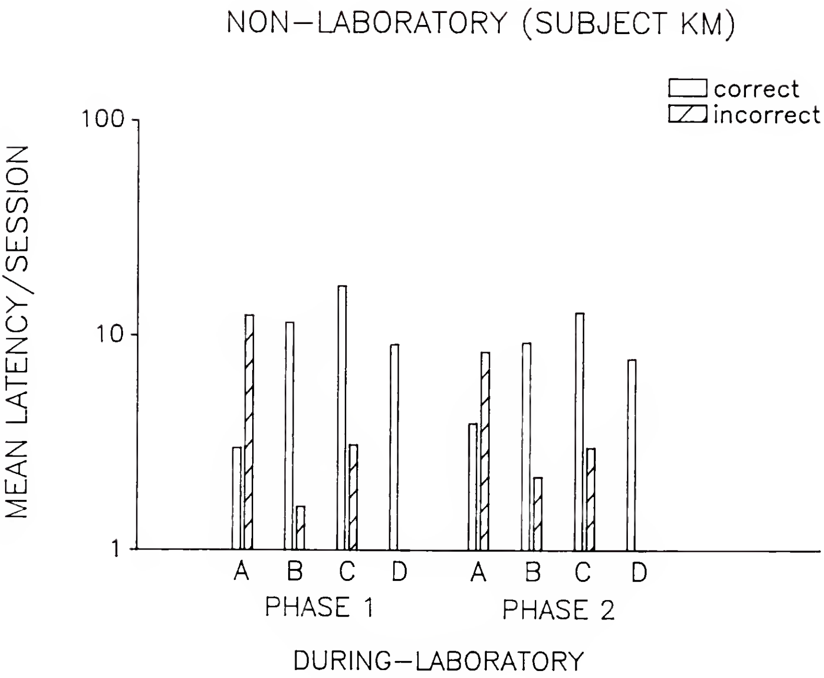
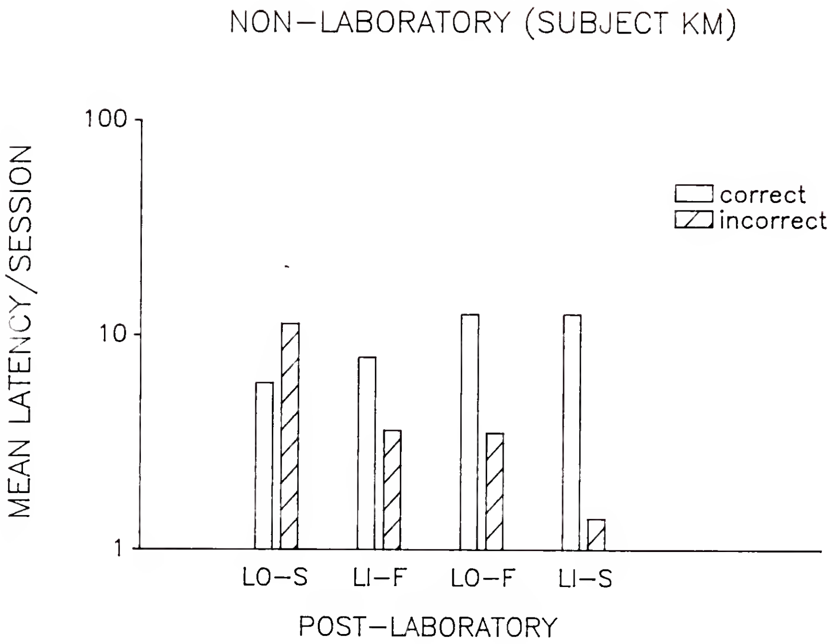

NON—LABORATORY (SUBJECT KM)
correct
incorrect
100
10
1
MEAN LATENCY/SESSION
A B C D
PHASE 1
A B C D
PHASE 2
DURING—LABORATORY

Figure 27. Non-laboratory data for subject KM after the implementation of laboratory training procedures (post-laboratory) are presented in bar graphs with a logarithmic y axis. The mean total latency/session correct and incorrect for all four stimuli are presented with respect to each non-laboratory procedure.


NON-LABORATORY (SUBJECT KM)
100
10
1
MEAN LATENCY/SESSION
correct
incorrect
LO-S
LI-F
LO-F
LI-S
POST-LABORATORY

11 stimulus pairs were acquired and trials to acquisition ranged from 56 to 153 with a mean of 131.3 and a SD of 61.4. During the laboratory program, 21 stimulus pairs were acquired, trials to acquisition ranged from 4 to 104 with a mean of 36.1 and SD of 31.3. After the end of the laboratory program (post-laboratory), 17 stimulus pairs were acquired, trials to acquisition ranged from 4 to 82 with a mean of 28.6 and SD of 29.1.

A t test comparing non-laboratory performance before and during laboratory training (see Table 2) indicated a significant decrease in trials to acquisition ($p < .01$). However, a comparison of non-laboratory performance during and after (post) laboratory training was not significant.

KM's performance improved during laboratory training and this improvement was maintained afterward. The relationships between correct and incorrect responses within the four non-laboratory procedures remained the same throughout training, and a reduction in trials to acquisition must be attributed to a generalized improvement, rather than improvement specific to any particular procedures.

DISCUSSION

Acquisition with non-laboratory procedures improved in 5 of the 6 subjects. This may have occurred as a result of the elimination of "error factors" with respect to the behavioral processes common to conditional discriminations generally, or with respect to specific non-laboratory procedures. For example, the non-laboratory performances of RG, DC, and KM improved significantly during and/or after laboratory training, but improvement did not occur differentially with respect to any of the four non-laboratory procedures. Conversely, the performances of subjects LT and KD improved significantly both during laboratory training and after it was discontinued, and these changes can be attributed to improvement in the Listen-Find and Look-Say, and Listen-Find performances, respectively. However, laboratory training could not have affected baseline acquisition by training a number of exemplars of conditional discriminations, because only a few identity conditional discriminations were acquired by RG and DC, and only TM acquired any non-identity conditional discriminations (TM's non-laboratory performance did not improve across any conditions). Furthermore, acquisition in the laboratory (with respect to the experimenter-defined criteria) was not necessary for significant improvement with respect to non-laboratory procedures. Subjects KD and KM learned little to nothing in the laboratory (again, with respect to the experimenter-defined criteria), but their non-laboratory performances improved significantly during laboratory training and KD's performance improved again once laboratory training was discontinued.

Quite often during non-laboratory training subjects emitted behavior that indicated sources of control other than the contingencies explicitly arranged by the experimenter. These responses may have mediated acquisition of the specified conditional discrimination or they may have provided additional error factors, interfering with acquisition. It was frequently observed with several subjects that the acoustic stimulus was unnecessarily emitted as a vocal response in both the Look-Find and Listen-Find procedures. For example, in the Look-Find procedure the experimenter would arrange four stimuli on the table in front of the subject and would present another stimulus (e.g., a picture of an elephant) that matched one of the four. While presenting this stimulus the experimenter would say, "Find this one". Whereas pointing to the matching stimulus on the table was the correct response, the subject would emit a vocal response (e.g., "horse") and then point to one of the stimuli on the table (maybe the picture of a horse, maybe the picture of an elephant).

It appeared that these vocal responses were controlled differentially within the different procedures. For example, in the Look-Find procedure the vocal response appeared to be controlled by the visual sample stimulus or by one of the four comparisons. The subject might look at the sample, emit a vocal response, then look at and point to one of the comparisons. Or the subject might look at the sample, then look at the comparisons. At this point the subject might either first emit the vocal response then point to a comparison, or he or she might first point to a comparison and then emit a vocal response. The sample and vocal response might or might not have correspondence (from the experimenter's point of view), and the vocal response and the pointed-to comparison might or might not have correspondence. In other words the vocal response might have "mediated" or it might have interfered with a correct response. (KEY: S = stimulus; Vocal R = Vocal Response; CO = comparison; > = correct relation; ≥ = incorrect relation). The eight possible sequences were as follows: 1) S > Vocal R ≥ CO; 2) S ≥ Vocal R > CO; 3) S > Vocal R > CO; 4) S ≥ Vocal R ≥ CO; 5) S > CO ≥ Vocal R; 6) S > CO > Vocal R; 7) S ≥ CO > Vocal R; and 8) S > CO ≥

Vocal R. If any but sequence 3 were observed during assessments, then they were viewed as "error factors" and were arranged to occur during teaching, and the desirable sequence was differentially reinforced.

Within the Listen-Find procedure the vocal response also could be controlled by the sample or one of the comparison stimuli. However, within this procedure the sample and vocal responses were in the acoustic modality, and echoic control appeared to be much more likely. Therefore, a correct relation between sample and vocal responses was much more frequently observed. However, because this conditional relation was non-identity, whereas Look-Find was identity, incorrect relations between sample and comparison stimuli were more often observed. Again, if these relations were observed during assessments, then they were arranged to occur during teaching and desirable sequences were differentially reinforced.

Another proximal source of control observed but not explicitly arranged by the experimenter was what might be called "self reinforcement". Again, this might have facilitated acquisition or it might have provided an additional error factor. During teaching procedures the experimenter paired the presentation of edibles with various forms of praise (e.g., "Good boy!", "That's right!", "Good job!", etc.). Frequently, the subject echoed this praise at the end of a trial and eventually the subject's vocal response came under the control of the end of the trial, rather than praise by the experimenter. This resulted in a vocal response made by the subject (in the same form as the "praise" presented by the experimenter) but subsequent to both correct and incorrect responses. It appeared likely that the subject's vocal response served as conditioned reinforcement, delivered after both correct and incorrect responses, which might exert proximal control. Certainly, if KM's self praise changed his responding, the ultimate control for both the "self reinforcement" response and the the response which was reinforced would reside in other common contingencies (see Catania, 1975). This response was interrupted during teaching and, because of its potential for disruption of the experimenter arranged contingencies, it was interrupted during assessments.

As stated previously, only subject TM acquired non-identity conditional discriminations during laboratory (automated) training, whereas all subjects acquired non-identity conditional discriminations within non-laboratory (human training) sessions. Several studies have compared automated and human instruction (Berthold & Sachs, 1974; Blackman & Capobianco, 1965; Malpass, Hardy, Gilmore, & Williams, 1964; Price, 1963; Richmond, 1983; Russo, Koegel, & Lovaas, 1978) and provide inconclusive results regarding the superiority of either method, along with a variety of explanations for the discrepant performances between settings. Except for two studies, Russo et al (1978) and Richmond (1983), these studies are incomparable due to 1) diversity in a) student populations, b) instructional methods, and c) content of instruction, and 2) insufficient descriptions of procedures and content.

In the Russo et al (1978) study, autistic children (9-12 years, who tested in the Profound range of retardation) were trained on identity conditional discriminations in a matching to sample format with a triangle on a red background and a circle on a green background. Performance remained low in the condition with automatic training alone. In conditions with either a teacher alone or teacher with automated training, performance improved. These experimenters concluded that, "While hardware and program of teaching machine were sufficient to produce criterion responding, teacher presence or absence was the determining factor in whether criterion was attained (p. 198)." These results warrant a closer examination.

In the machine-alone condition, a sample stimulus was presented after a 15 second inter-trial interval during which all keys had been dark. A response to the sample key resulted in the presentation of comparison stimuli. A correct response resulted in the presentation of food, a food cup light, and a bell. Incorrect responses resulted in an inter-trial interval (15 seconds) followed by a correction procedure (i.e., presentation of the same stimuli and arrangement as in the last trial).

In the teacher-alone condition, the teacher presented a sample stimulus in a mechanical device similar to the machine apparatus, but if there was no response after three seconds (s)he said, "Match". When the child responded to the sample stimulus, the experimenter removed a flap to expose the comparison stimuli. Correct responses were followed by praise (e.g., "Good boy!") and food. Incorrect responses resulted in an inter-trial interval (15 seconds) and a correction procedure. During the inter-trial interval the experimenter did not interact with the subject.

In the teacher-with-machine condition, a sample stimulus was presented by the experimenter when the subject was "seated quietly, hands in lap, and facing the panel." Consequences for correct responses included those delivered in the machine alone condition with the addition of praise (e.g., "Good boy!"). Consequences for incorrect responses involved the combination of the machine alone and teacher alone conditions.

Russo and his colleagues suggested that possible variables of teacher presence might be: 1) saliency of social reinforcement, 2) a failure in motivation (e.g., satiation), and 3) a failure to control antecedent stimulus variables. However, it appeared to them that with respect to the first possibility, praise was irrelevant in the teacher with machine condition. The evidence upon which they based this conclusion was that all subjects retrieved reinforcers before praise was presented. With respect to the second proposed variable, they concluded that satiation was a viable possibility and that after a number of successive trials subjects were likely to cease to respond correctly and engage in off-task behaviors. Finally, they observed that antecedent stimulus variables appeared to be important. In the machine alone condition subjects were often out of their seats, were turned around in their chairs, or otherwise were not looking at the stimulus display at trial onset. They agreed with Schreibman & Koegel (1975) and concluded that the control of antecedent stimuli and off-task behavior is necessary for autistic children to learn.

However, in the present experiment, although the control of antecedent stimuli and off task behavior may have been important variables for subjects LT and KD, four of the subjects (KM, DC, RG, and TM) engaged in virtually no off-task behavior, sat quietly within sessions, and between trials faced the panel with their hands poised to respond prior to the presentation of sample stimuli.

In another experiment comparing machine (micro-computer) and human training, Richmond (1983) trained the performance of retarded subjects, tested in the range of

Moderate to Profound, with respect to simple discriminations between pictures of a spoon and fork, hairbrush and toothbrush, scissors and pliers, and between pictures of a screw and a nail. Procedures were the same except for the instruction "Touch one" at the beginning of each trial with human training, and the details of reinforcement presentation. In both the human and automated conditions, the same kind of edibles were presented. In the human condition, praise (e.g., "Good touching!") and a stroke on the back were added after correct responses, and the statement "No!" was added after incorrect responses. In the automated condition, the eyes flashed on a clown's face on the computer screen after a correct response, paired with an edible.

Richmond (1983) found that older and higher functioning subjects benefitted from automatic instruction, and that performance improved for subjects who had previous experience with automated training. Language did not differentiate between successful and unsuccessful subjects with respect to automated instruction. Richmond concluded that the technology for human instruction is further advanced than for automatic instruction. However, it is not apparent, nor was it explained what was more advanced about the human condition as described above. One explanation might be that these researchers varied the human condition, but did not report those variations.

Within the present research project there were several differences between non-laboratory (human instruction) and laboratory (automated) training. For example, only edibles were delivered as reinforcers during the laboratory training, while edibles and praise were delivered within non-laboratory teaching sessions.

Additionally, although the laboratory training provided greater consistency, table-top training allowed much more flexibility. Varieties of prompting and fading were available through teaching in the table-top condition, but were arranged only with much difficulty, if at all, in the laboratory. Examples of such techniques include holding the subject's hands on the table, preventing a response until he or she looked at the comparison stimuli; fading out sample and comparison juxtaposition; eliminating and then fading back in particular comparisons; covering the comparisons until the subject looked at the sample; trial order was flexible: correction, repeats after correct responses, and juxtaposing two pairs.

A third difference can be found in apparent similarities. The laboratory arrangement (identity matching) was similar to Look-Find in the non-laboratory, (i.e. the stimuli were formally similar and were both in the visual modality). Although this procedure is theoretically expected (and generally observed) to be easier for most subjects than Look-Say and Listen-Find, it is likely that training for these relations is less frequently arranged for, or encountered by, institutionalized retarded subjects. This might contribute to the more rapid acquisition of the non-laboratory stimuli (in the Look-Say and Listen-Find procedures) as opposed to laboratory stimuli.

A critical difference between laboratory and non-laboratory procedures may have been identified in basic conditional discrimination research. Urcuioli and Honig (1976) suggested that matching-to-sample is a composite of two sample discriminations, a successive discrimination between the sample stimuli and a simultaneous discrimination between the comparison stimuli. Furthermore, Lattal (1975, 1979) and Ziriaxi and Silberberg (1978) presented evidence that cues associated with differential sample responding can control accurate responding in two-choice conditional discriminations. Cohen, Looney, Brady, Aucella (1976) arranged discrimination training and matching-to-sample training with pigeons involving differential response requirements (DRL 3 vs. FR 16) for food reinforcement or the presentation of comparison stimuli, respectively, in the presence of each sample stimulus. They reported faster matching-to-sample acquisition with differential than with non-differential sample-response requirements.

In the present study, the table-top trained conditional discriminations (Listen-Find) involved an auditory stimulus which was used during training with supplemental procedures (Look-Say and Listen-Say), providing a differentiated vocal response. Laboratory conditional discriminations did not involve an explicitly trained differential response.

In conclusion, the performance of 4 of the 6 subjects improved significantly during laboratory training with respect to trials to acquisition in the non-laboratory training. Only the performances of TM and DC remained the same. All subjects, except TM, either maintained this improvement or made further significant improvement after training in the laboratory was discontinued. Initial non-laboratory performance did not consistently predict either performance in the laboratory (i.e., TM) or improvement of non-laboratory performance. Changes in performance leading to significance were either specific to particular procedures (subjects KD and LT) or spread across all procedures (RG, DC, and KM). Furthermore, because few identity conditional discriminations were acquired by any subject, and only TM acquired non-identity conditional discriminations, acquisition of numerous exemplars of conditional discriminations could not explain the acceleration of acquisition in the non-laboratory setting. If laboratory training was responsible for improved non-laboratory acquisition, then it is likely that the vehicle for this change was either the elimination of "error factors" or improvement with respect to processes more basic than conditional discriminations. However, improvements once laboratory training was discontinued strengthens the interpretation that extended non-laboratory training was the controlling variable.

At least with respect to training conditional discriminations, it appears that the "machine" (laboratory) in this experiment was not more efficient or effective than the human (non-laboratory). An important focus for future research is the basis for differences in acquisition of conditional discriminations between the laboratory and non-laboratory settings. Some possible variables contributing to these differences were suggested by Russo et al (1978), Richmond (1983), and within this experiment. However, until the necessary and sufficient conditions that give rise to conditional discriminations are identified, it will be impossible to arrange precisely the specific procedures necessary to promote acquisition of these relations at the "process" level. The possibility of laboratory process training might be fully realized with respect to complex stimulus control once the components of conditional discriminations are better understood. The research by Urcuioli and Honig (1976), investigating the contributions to conditional discriminations of enhanced discrimination vs. a differential response, appears to be an important (if not the most important) direction for future research in this area.

It appears that future applications of laboratory "process" training are likely to be more effective with subjects that display deficits that are more fundamental than the desired terminal performances. For example, with some subjects improvement on the Look-Find and Listen-Find procedures led to more rapid acquisition with respect to the Look-Say procedure, which universally is considered more difficult. Furthermore, although the complexity of stimulus relations trained in the laboratory did not approximate the complexity of non-laboratory relations, training in the former setting appeared to improve performance in the latter. Finally, non-laboratory training appeared to be as effective (if not more effective) than laboratory training. Future attempts at "process" training might therefore be effectively arranged in a non-laboratory setting with a human trainer.

APPENDIX A

STANDARDIZED TEST SCORES

Subject	Test	Test Results	Level
RG	SB (LM)	MA = 3 years, 4 months; IQ < 36	Severe
	VABS	AE = 2 years, 8 months	
DC	SB (LM)	MA = 3 years, 4 months; IQ < 36	Severe
	VABS	AE = 2 years, 1 month	
TM	PPVT	MA = 3 years, 1 month; IQ = 21	Severe
	VABS	AE = 2 years, 6 months	
LT	SB (LM)	MA = 2 years, 9 months; IQ < 20	Profound
	VABS	AE = 2 years, 2 months	
KD	SB (LM)	MA = 2 years, 10 months; IQ = 19	Profound
	VABS	AE = 1 year, 9 months	
KM	LIPS	MA = 3 years, 3 months; IQ = 25	Severe
	VABS	AE = 2 years, 3 months	

IQ	LEVEL
0-19	Profound
20-35	Severe

KEY:

SB (LM) = Stanford-Binet form LM
MA = mental age
AE = age equivalence
VABS = Vineland Adaptive Behavior Scales
PPVT = Peabody Picture Vocabulatory Test
LIPS = Leiter International Performance Scales

APPENDIX B
DATA RECORDING SHEET

Non-laboratory data recording sheet. Correct responses (C), incorrect responses (IC), and latency of response (T) to the tenth of a second were recorded.

RECORDING SHEET

Subject: ______________________________

Date: ______________________________

	Assessessment C	IC	T		Re-Assessment C	IC	T	
LOOK-SAY				*				
1				*				
2				*				
3				*				
4				*				
				*				
LISTEN-FIND				*				
1				*				
2				*				
3				*				
4				*				
				*				
LOOK-FIND				*				
1				*				
2				*				
3				*				
4				*				
				*				
LISTEN-SAY				*				
1				*				
2				*				
3				*				
4				*				

APPENDIX C
DATA FOR SUBJECT RG

Laboratory and non-laboratory data for subject RG. Laboratory data are calculated in mean responses/minute/session with total session duration as the denominator in Phase 1 and cumulative latency from sample to comparison responses in Phases 2 & 3. Non-laboratory data are presented with total latencies for correct and incorrect responses across all four stimuli separated with respect to each procedure (Look-Say, Listen-Find, Look-Find, and Listen-Say).

APPENDIX C

DATA FOR SUBJECT RG

Laboratory

	Comparisons (1) C	(1) IC	(2) C	(2) IC
Session				
Phase 1.				
1	4.2	00.0	----	----
2	4.7	00.0	----	----
3	6.4	00.0	----	----
Phase 2.				
1	36.0	12.0	54.0	0.0
2	96.0	42.0	66.0	0.0
3	30.0	18.0	36.0	0.0
4	36.0	18.0	42.0	6.0
5	18.0	6.0	48.0	6.0
6	42.0	18.0	42.0	3.0
7	36.0	18.0	48.0	60.0
8	36.0	18.0	54.0	4.8
9	36.0	18.0	6.0	0.0
10	36.0	12.0	6.0	0.0
11	36.0	12.0	42.0	6.0
12	30.0	18.0	42.0	2.4
13	36.0	12.0	36.0	12.0
14	24.0	12.0	----	----
15	24.0	12.0	48.0	3.6
16	24.0	12.0	24.0	0.0
17	18.0	2.4	42.0	3.0
18	42.0	12.0	6.0	0.0
19	42.0	3.0	6.0	0.0
20	36.0	6.0	54.0	0.0
21	30.0	4.2	6.0	0.0
22	48.0	0.0	6.0	5.4
23	36.0	12.0	----	----

Phase 3.

1	6.0	60.0	12.0	6.6
2	36.0	6.0	24.0	18.0
3	48.0	6.0	24.0	18.0
4	30.0	24.0	24.0	18.0
5	48.0	12.0	36.0	12.0
6	54.0	6.0	24.0	18.0
7	42.0	6.0	36.0	18.0
8	30.0	6.0	36.0	18.0
9	42.0	6.0	24.0	18.0
10	24.0	18.0	36.0	18.0
11	36.0	6.0	24.0	18.0
12	54.0	00.0	36.0	12.0
13	30.0	6.0	36.0	18.0
14	54.0	00.0	24.0	24.0
15	54.0	00.0	36.0	18.0
16	----	----	24.0	12.0
17	----	----	30.0	12.0
18	54.0	00.0	42.0	6.0
19	54.0	00.0	30.0	24.0
20	----	----	18.0	24.0
21	----	----	36.0	6.0
22	----	----	24.0	18.0
23	----	----	24.0	18.0
24	60.0	00.0	48.0	18.0
25	60.0	00.0	24.0	24.0
26	54.0	00.0	132.0	228.0
27	54.0	00.0	18.0	30.0
28	54.0	00.0	18.0	36.0
29	6.6	00.0	30.0	36.0
30	54.0	00.0	30.0	30.0
31	60.0	00.0	18.0	30.0
32	60.0	00.0	18.0	36.0
33	66.0	00.0	24.0	30.0
34	48.0	00.0	24.0	30.0
35	48.0	00.0	24.0	36.0
36	60.0	00.0	30.0	30.0
37	6.6	00.0	18.0	30.0
38	6.6	00.0	24.0	24.0
39	54.0	00.0	18.0	36.0
40	60.0	00.0	12.0	36.0
41	54.0	00.0	12.0	30.0
42	48.0	00.0	12.0	30.0
43	96.0	00.0	12.0	30.0
44	60.0	00.0	18.0	24.0
45	48.0	00.0	12.0	30.0
46	48.0	00.0	12.0	24.0
47	54.0	00.0	6.6	12.0
48	24.0	00.0	12.0	24.0
49	12.0	12.0	18.0	24.0

50	36.0	00.0	30.0	18.0
51	18.0	00.0	12.0	30.0
52	48.0	00.0	24.0	24.0
53	48.0	00.0	12.0	24.0
54	----	----	24.0	12.0

Pre-laboratory (Subject RG)

	Look-Say		Listen-Find		Look-Find		Listen-Say	
Session #	C	IC	C	IC	C	IC	C	IC
1	0	7.4	3.0	11.0	12.6	0	6.9	0
2	3.7	4.5	6.3	0	10.3	0	4.1	4.7
3	0	8.0	8.7	0	7.2	0	5.2	0
4	0	9.3	5.2	0	8.8	0	6.5	0
5	5.1	2.4	5.2	0	9.0	0	4.1	0
6	0	10.7	7.2	3.0	9.0	0	4.9	0
7	2.3	7.4	5.3	0	9.6	0	3.6	0
8	2.4	8.5	5.3	0	11.3	0	4.7	0
9	4.7	4.2	7.8	0	7.8	0	5.1	0
10	2.3	7.1	4.2	5.1	8.9	0	4.5	0
11	0	9.9	2.5	4.7	8.6	0	4.4	0
12	4.9	4.3	7.0	0	7.2	0	6.6	0
13	1.9	7.6	6.7	0	8.4	0	4.9	0
14	2.6	9.4	6.1	0	9.8	0	4.5	0
15	6.3	2.7	6.5	0	6.4	0	5.4	0
16	0	13.7	11.0	2.1	6.4	6.3	7.2	0
17	5.7	4.5	5.9	0	9.0	0	6.2	0
18	0	9.2	10.4	3.9	11.7	0	6.4	0
19	4.6	7.4	7.2	0	10.9	0	7.4	0
20	2.3	7.6	9.9	0	6.0	0	4.9	0
21	5.5	1.8	5.8	0	7.9	0	5.6	0
22	5.0	2.4	6.4	0	9.3	0	4.9	0
23	1.6	5.4	7.6	0	8.4	0	5.0	0
24	5.5	1.3	5.7	0	9.2	0	6.4	0
25	0	7.8	8.0	0	10.0	0	5.6	0
26	1.8	6.8	7.0	0	10.4	0	5.1	0
27	0	8.9	1.9	6.9	7.5	0	6.0	0
28	3.8	4.8	15.2	0	8.8	0	3.4	1.7
29	2.3	5.5	5.7	5.7	9.7	0	7.5	0
30	0	13.0	7.3	3.4	11.6	0	16.0	0
31	5.9	2.5	9.4	0	8.2	0	5.2	0
32	0	10.2	5.5	11.3	10.0	0	6.2	0

During-laboratory

33	0	11.4	5.6	3.3	7.3	0	6.1	0
34	2.6	2.7	9.1	0	8.3	0	6.9	0
35	7.7	4.4	14.1	0	13.9	0	7.5	0

36	5.2	2.9	9.0	0	9.2	0	6.8	0
37	3.4	5.8	7.7	0	7.9	0	4.4	0
38	5.1	2.0	7.7	0	6.9	0	3.5	1.6
39	0	7.2	4.9	6.6	8.7	0	4.2	0
40	2.9	4.5	6.2	2.7	11.0	0	4.7	0
41	1.5	9.8	9.3	0	10.0	0	5.8	0
42	1.7	4.6	7.2	2.4	12.8	0	4.7	0
43	6.5	4.1	6.6	0	8.9	0	3.2	0
44	2.4	8.3	10.7	0	8.4	0	8.6	0
45	4.4	0	4.8	0	6.5	0	3.3	0
46	1.2	6.4	4.7	1.7	5.4	0	4.6	0
47	8.6	1.7	6.1	0	6.6	0	4.0	0
48	0	7.4	6.9	2.1	11.5	0	5.4	0
49	3.4	3.5	5.8	2.4	9.4	0	4.6	0
50	1.4	3.0	10.0	0	11.1	0	4.5	0
51	4.2	5.2	7.3	0	8.6	0	5.3	0
52	3.5	3.8	8.2	0	17.9	0	4.2	0
53	0	8.4	5.3	0	7.0	0	3.6	0
54	6.8	1.9	7.3	0	4.0	3.4	3.6	0
55	2.9	4.2	6.6	0	7.0	0	5.2	0
56	4.9	2.9	4.3	0	6.6	0	4.0	0
57	4.5	3.2	6.8	0	6.1	0	3.1	0
58	3.2	5.0	5.6	0	8.4	0	3.8	0
59	2.7	11.0	3.5	0	9.0	0	4.0	0
60	3.7	3.8	2.9	4.6	7.5	0	4.0	0
61	2.6	3.8	7.0	0	6.9	0	4.7	0
62	1.9	5.1	7.5	0	7.5	0	4.4	0
63	0	9.0	10.1	0	8.2	0	9.6	0
64	1.5	5.2	7.0	0	6.9	0	4.9	0
65	3.6	2.9	3.2	1.9	6.5	0	5.6	0
66	1.3	5.6	4.3	1.3	7.4	0	5.2	0
67	1.5	7.0	8.1	0	6.2	0	4.0	0
68	1.3	4.8	6.6	0	5.3	0	4.4	0
69	3.5	2.8	6.6	0	8.0	0	3.9	0
70	1.9	5.6	6.8	0	7.3	0	3.1	0
71	2.8	3.7	9.3	0	6.7	0	4.7	0
72	3.5	4.0	6.6	0	6.0	1.9	3.4	0
73	4.5	1.5	6.7	0	6.6	0	3.5	0
74	6.4	0	6.3	0	7.1	0	2.8	0
75	4.5	3.3	3.3	0.9	9.4	0	4.4	0
76	0	5.4	4.2	0	3.1	1.5	2.2	0
77	5.3	0	3.9	0	3.2	0	1.8	0
78	0	6.9	5.3	1.1	6.8	0	3.7	0
79	1.7	4.9	4.6	1.7	7.2	0	4.9	0
80	3.2	3.4	6.0	0	4.3	0	3.8	0
81	1.6	4.7	5.5	0	5.9	0	4.4	0
82	2.9	3.3	3.6	0	5.7	0	3.7	0
83	2.9	3.4	3.8	0	6.5	0	4.4	0
84	2.5	3.2	4.2	0	4.8	0	4.0	0
85	0	8.7	2.4	4.4	8.6	0	5.4	0
86	0	7.5	7.7	0	6.8	0	3.3	0

87	1.3	5.9	4.8	0	5.5	0	3.4	0
88	4.4	1.6	4.3	0	5.5	0	4.5	0
89	1.5	6.3	5.5	0	4.9	0	2.1	0
90	0	5.4	5.1	0	5.1	0	2.5	0
91	5.7	0	5.5	0	4.5	0	2.3	0
92	0	8.7	3.3	3.5	6.1	0	4.3	0
93	3.5	3.6	5.2	1.3	6.0	0	3.8	0
94	6.6	0	4.7	0	5.8	0	2.5	0
95	0	8.0	1.4	2.4	7.1	0	3.5	0
96	1.5	4.9	5.0	1.6	6.8	0	4.0	0
97	4.8	1.5	5.0	0	5.6	0	5.2	0
98	1.3	5.9	5.5	0	4.8	0	2.9	0
99	1.1	4.3	5.5	0	6.6	0	4.3	0
100	4.3	1.7	8.4	0	4.8	0	3.1	0
101	0	7.7	5.9	0	5.7	0	4.0	0
102	5.3	1.7	6.0	0	7.7	0	3.4	0
103	0	7.7	6.5	0	6.5	0	3.7	0
104	6.0	0	7.4	0	3.0	0	3.0	0
105	0	6.8	6.2	0	5.6	0	3.7	0
106	6.1	0	5.3	0	7.6	0	3.3	0
107	0	5.9	5.5	0	5.0	0	3.0	0
108	4.4	0	2.1	0	4.1	0	2.9	0
109	0	6.3	4.7	0	6.0	0	3.4	0
110	6.4	0	5.8	0	7.6	0	3.6	0
111	0	7.9	1.3	4.5	6.0	0	5.2	0
112	0	7.1	3.0	2.3	7.2	0	4.6	0
113	5.8	0	4.6	0	6.4	0	3.5	0
114	0	6.7	5.2	0	8.1	0	4.9	0
115	2.2	8.5	9.0	0	8.4	0	5.2	0
116	5.5	1.3	7.9	7.2	9.1	0	5.2	0
117	0	6.2	7.0	0	6.5	0	4.0	0
118	6.5	0	5.4	0	4.7	0	3.0	0
119	0	4.7	4.0	1.2	7.1	0	3.6	0
120	3.4	2.7	4.8	0	5.3	0	5.5	0
121	1.9	4.5	5.3	1.7	7.1	0	3.5	0

Post-laboratory

122	4.9	1.9	3.6	1.6	5.3	0	3.7	0
123	0.9	4.2	4.8	0	5.7	0	4.2	0
124	3.2	3.2	5.6	0	5.0	0	4.5	0
125	1.4	4.8	2.8	3.4	5.4	0	5.9	0
126	2.9	3.0	6.1	0	6.4	0	5.0	0
127	1.0	6.0	3.8	1.3	5.9	0	3.7	0
128	4.7	2.3	4.3	1.2	6.5	0	4.7	0
129	0	7.1	4.3	1.6	6.3	0	5.0	0
130	6.4	0	4.7	0	5.5	0	4.4	0
131	0	8.4	5.3	0	6.1	0	4.7	0
132	2.7	4.0	4.9	0	6.0	0	5.2	0
133	0	5.6	6.0	0	8.1	0	3.8	0
134	4.1	1.2	3.7	1.5	5.1	0	3.1	0

135	1.6	5.5	6.6	0	5.9	0	4.7	0
136	2.5	2.9	5.0	0	5.4	0	4.1	0
137	2.8	3.8	5.5	0	4.3	1.2	4.6	0
138	2.6	4.5	6.2	0	5.9	0	4.6	0
139	1.3	5.3	5.5	0	6.5	0	5.8	0
140	3.4	3.6	6.0	0	5.9	0	5.4	0
141	2.9	3.2	5.1	0	5.3	0	3.6	0
142	2.9	3.7	5.0	0	7.0	0	4.7	0
143	2.4	3.7	4.3	1.2	6.6	0	5.0	0
144	0	8.0	5.2	1.3	6.4	0	4.5	1.2
145	6.1	0	4.6	0	5.8	0	4.2	0
146	0	7.3	5.0	1.6	7.3	0	5.7	0
147	7.1	0	6.8	0	6.5	0	4.4	0
148	0	8.0	6.6	0	7.3	0	5.3	0
149	6.4	0	5.8	0	7.1	0	3.8	0
150	0	7.5	1.8	4.4	8.2	0	5.7	0
151	5.3	1.6	7.9	0	6.1	0	5.5	0
152	1.6	5.4	6.1	0	7.0	0	4.9	0
153	4.6	1.8	6.3	0	6.4	0	4.3	0
154	1.7	5.9	6.0	0	6.7	0	4.0	0
155	1.6	5.1	5.9	0	5.4	0	5.2	0
156	4.2	1.7	5.9	0	6.8	0	5.5	0
157	0	7.1	6.4	0	5.2	1.5	5.5	0
158	6.4	0	4.9	0	5.8	0	4.4	0
159	0	7.9	1.5	4.3	6.3	0	5.1	0
160	6.4	0	5.3	0	5.9	0	4.1	0
161	0	7.6	6.1	0	5.6	0	5.1	0
162	4.1	1.7	3.7	1.6	5.2	0	5.4	0
163	2.6	3.1	5.5	0	6.7	0	5.8	0
164	2.6	3.5	4.1	0	6.3	0	5.3	0
165	3.3	4.0	5.1	0	6.2	0	5.6	0
166	3.5	2.8	6.0	0	6.7	0	4.3	0
167	3.1	4.0	4.9	1.2	7.1	0	4.6	0
168	3.0	3.0	5.7	0	6.4	0	4.7	0
169	2.8	2.8	7.2	0	4.7	0	5.0	0
170	1.3	4.8	5.7	0	7.6	0	5.0	0
171	3.9	1.6	4.7	0	5.6	0	4.0	0
172	1.7	4.0	6.3	0	7.4	0	4.4	0
173	5.3	1.6	4.7	0	5.8	0	4.0	0
174	0	8.2	4.8	1.3	6.3	0	4.9	0
175	7.8	0	5.9	0	5.8	0	5.6	0
176	0	9.8	4.4	0	7.0	0	5.3	0
177	5.8	0	5.7	0	5.7	0	4.4	0
178	0	7.1	5.4	0	5.3	0	4.6	0
179	5.0	0	6.1	0	6.2	0	5.7	0

APPENDIX D
DATA FOR SUBJECT DC

Laboratory and non-laboratory data for subject DC. Laboratory data are calculated in mean responses/minute/session with total session duration as the denominator in Phase 1 and cumulative latency from sample to comparison responses in Phases 2 & 3. Non-laboratory data are presented with total latencies for correct and incorrect responses across all four stimuli separated with respect to each procedure (Look-Say, Listen-Find, Look-Find, and Listen-Say).

APPENDIX D

DATA FOR SUBJECT DC

Laboratory

	Comparisons			
	(1)		(2)	
	C	IC	C	IC
Session				
Phase 1.				
1	4.1	.3	----	----
2	5.8	00.0	----	----
3	.2	00.0	----	----
Phase 2.				
1	24.0	00.0	15.6	6.0
2	24.0	2.4	18.0	6.0
3	24.0	00.0	18.0	1.8
4	30.0	4.8	72.0	54.0
5	24.0	00.0	12.0	12.0
6	24.0	3.0	18.0	12.0
7	30.0	00.0	24.0	12.0
8	30.0	00.0	30.0	00.8
9	18.0	00.0	42.0	00.0
10	42.0	00.0	18.0	00.0
11	18.0	4.8	18.0	54.0
12	18.0	5.4	24.0	6.0
13	24.0	6.0	30.0	2.4
14	30.0	2.4	36.0	00.0
15	36.0	00.0	24.0	1.8
16	24.0	1.8	30.0	00.0
17	30.0	00.0	----	----
Phase 3.				
1	00.0	00.0	12.0	12.0
2	6.0	1.8	4.8	12.0
3	12.0	2.4	4.8	24.0
4	8.4	7.2	6.0	30.0

5	18.0	7.8	12.0	12.0
6	30.0	2.4	12.0	18.0
7	13.2	3.0	18.0	18.0
8	19.2	1.8	12.0	18.0
9	18.0	1.8	78.0	84.0
10	24.0	3.6	12.0	7.2
11	24.0	1.8	12.0	6.0
12	24.0	1.8	18.0	12.0
13	24.0	00.0	12.0	6.0
14	36.0	00.0	18.0	6.0
15	24.0	2.4	18.0	6.0
16	24.0	6.0	24.0	6.0
17	42.0	00.0	12.0	12.0
18	36.0	6.0	18.0	6.0
19	24.0	6.0	18.0	6.0
20	12.0	12.0	18.0	6.0
21	12.0	1.2	18.0	1.8
22	24.0	00.0	18.0	6.0
23	36.0	00.0	12.0	6.0
24	30.0	2.4	12.0	12.0
25	30.0	3.6	18.0	6.0
26	42.0	00.0	18.0	12.0
27	30.0	00.0	24.0	12.0
28	54.0	00.0	6.0	3.0
29	36.0	00.0	30.0	5.4
30	30.0	00.0	6.0	0.6
31	36.0	00.0	24.0	6.0
32	48.0	00.0	12.0	12.0
33	36.0	00.0	18.0	12.0
34	36.0	00.0	12.0	12.0
35	36.0	00.0	12.0	12.0
36	4.2	00.0	4.2	12.0
37	36.0	00.0	12.0	12.0
38	36.0	00.0	12.0	12.0
39	36.0	00.0	18.0	12.0
40	36.0	00.0	1.2	1.2
41	36.0	18.0	18.0	6.0
42	36.0	00.0	18.0	12.0
43	42.0	4.8	18.0	12.0
44	36.0	6.0	24.0	6.0
45	36.0	00.0	12.0	6.0
46	30.0	00.0	12.0	12.0
47	24.0	00.0	24.0	6.0
48	36.0	00.0	12.0	12.0
49	36.0	00.0	12.0	12.0
50	48.0	00.0	24.0	6.0
51	42.0	00.0	24.0	12.0
52	30.0	00.0	18.0	1.2
53	30.0	02.4	30.0	00.0
54	30.0	3.6	30.0	3.0

55	42.0	00.0	36.0	00.0
56	30.0	00.0	30.0	00.0
57	6.0	00.0	42.0	12.0
58	54.0	00.0	24.0	12.0
59	36.0	00.0	18.0	12.0
60	30.0	00.0	18.0	4.2
61	24.0	00.0	48.0	4.2
62	36.0	00.0	42.0	3.0
63	24.0	00.0	18.0	12.0
64	30.0	00.0	18.0	6.0
65	30.0	00.0	24.0	12.0
66	42.0	00.0	36.0	2.4
67	42.0	00.0	24.0	6.0
68	18.0	00.0	42.0	00.0
69	24.0	00.0	30.0	3.0
70	42.0	00.0	24.0	4.2
71	36.0	00.0	24.0	3.6
72	30.0	00.0	24.0	00.0
73	24.0	00.0	12.0	12.0
74	24.0	00.0	18.0	12.0
75	30.0	00.0	6.0	6.0
76	48.0	00.0	18.0	12.0
77	30.0	00.0	18.0	1.2
78	48.0	00.0	36.0	00.0
79	42.0	00.0	42.0	00.0
80	42.0	00.0	18.0	6.0
81	36.0	00.0	24.0	1.2
82	42.0	2.4	24.0	3.0
83	30.0	00.0	18.0	6.0
84	36.0	00.0	36.0	3.6
85	42.0	00.0	36.0	00.0
86	42.0	00.0	24.0	1.8
87	12.0	00.0	----	----

Pre-laboratory (Subject DC)

	Look-Say		Listen-Find		Look-Find		Listen-Say	
Session #	C	IC	C	IC	C	IC	C	IC
1	0	36.9	17.7	10.0	19.1	0	21.1	0
2	10.8	26.6	22.7	0	34.2	0	10.1	0
3	10.8	1.8	13.7	0	17.6	0	11.0	0
4	36.5	10.0	40.1	0	32.4	0	28.5	0
5	12.1	30.0	42.1	0	26.7	0	35.9	0
6	15.7	22.5	18.1	0	18.2	0	11.8	0
7	2.2	27.1	22.5	0	19.6	0	24.5	0
8	54.4	10.0	13.8	0	12.8	0	12.2	0
9	12.7	30.0	20.3	0	17.0	0	16.2	10.0
10	23.8	10.0	12.0	0	12.9	0	22.1	0

11	17.2	20.0	15.4	0	22.0	0	21.5	0
12	2.3	30.2	14.4	0	15.3	0	19.4	0
13	13.5	19.3	8.1	0	6.5	0	14.0	0
14	19.4	30.0	25.1	0	21.6	0	21.9	0
15	35.3	0	14.2	0	10.3	0	15.9	0
16	0	38.9	33.3	0	13.6	0	17.4	0
17	8.1	30.0	19.3	0	14.0	0	12.5	0
18	47.0	10.0	15.9	0	12.7	2.7	11.8	0
19	34.6	0	14.2	0	9.3	0	10.5	0
20	27.0	0	13.5	0	14.2	0	9.7	0
21	36.9	10.0	24.3	0	12.5	0	9.1	0
22	3.8	30.0	34.4	0	15.3	0	11.9	0
23	27.1	30.0	15.2	0	11.7	0	10.3	0
24	16.2	26.0	15.6	0	9.6	0	10.0	0
25	10.0	30.0	13.0	0	11.5	0	7.7	0
26	0	30.2	8.8	4.8	10.9	0	10.2	0
27	0	40.0	29.9	0	22.7	0	31.9	0
28	12.5	20.0	26.1	0	15.2	0	8.5	0
29	13.0	20.0	22.1	0	6.1	0	10.8	0
30	0	38.9	8.3	2.7	12.7	0	7.5	0
31	31.1	10.0	15.2	0	10.9	0	6.4	0
32	0	33.1	11.3	0	13.5	0	8.4	0
33	35.3	10.0	13.0	0	8.7	0	6.2	0
34	14.5..	29.4	16.1	0	22.5	0	24.4	0

During-laboratory

35	0	40.0	11.4	10.0	12.1	0	13.9	0
36	45.1	10.0	7.9	0	11.2	0	6.9	0
37	16.2	18.8	18.8	0	7.2	0	8.1	0
38	27.4	20.0	31.2	4.5	11.5	0	16.2	0
39	0	40.0	18.7	10.0	13.1	0	12.9	0
40	10.4	30.0	23.3	0	9.9	0	19.5	0
41	4.2	30.0	23.4	0	9.6	0	6.1	0
42	37.0	30.0	24.2	0	15.0	0	12.5	0
43	74.7	10.0	20.2	0	24.3	0	23.5	0
44	24.5	30.0	14.2	3.4	12.0	0	26.2	0
45	44.3	10.0	27.2	0	15.7	0	20.3	0
46	42.3	20.0	24.5	0	31.9	0	31.5	0
47	85.0	10.0	26.5	0	15.8	0	21.9	0
48	7.2	8.2	12.0	8.7	13.1	0	13.3	0
49	131.6	14.1	32.6	0	13.5	0	65.0	0
50	13.0	30.0	11.4	0	9.5	0	14.3	0
51	64.9	20.0	20.2	3.0	15.2	0	18.6	0
52	0	40.0	17.1	0	12.8	0	25.5	0
53	65.9	10.0	19.3	0	16.2	0	14.5	0
54	49.6	30.0	12.4	10.0	16.1	0	22.0	0
55	13.8	30.0	18.9	0	9.4	0	14.7	0
56	6.1	18.5	10.1	0	10.6	0	12.9	0
57	9.0	30.0	10.7	0	8.5	0	16.1	0
58	14.2	25.0	12.5	0	8.7	0	22.8	0

59	61.8	20.0	23.0	0	8.4	0	11.3	0
60	14.7	30.0	19.6	0	11.9	0	12.2	0
61	11.3	29.5	22.3	0	12.0	0	14.5	0
62	24.0	20.0	9.2	0	11.4	0	12.6	0
63	15.7	40.0	12.1	18.6	16.4	4.0	16.1	0
64	37.5	5.8	21.0	0	18.4	0	18.3	0
65	2.8	30.0	3.2	22.8	12.8	0	30.5	0
66	6.6	40.0	14.2	10.0	15.3	0	16.3	0
67	31.1	10.0	17.7	0	12.5	0	14.7	0
68	0	36.8	12.2	10.0	14.7	0	34.3	0
69	20.8	30.0	23.1	0	13.5	0	14.1	0
70	25.3	20.0	24.7	0	15.1	0	26.1	0
71	0	40.0	21.2	0	15.1	0	14.2	0
72	112.8	20.0	11.5	0	17.5	0	13.8	0
73	11.1	20.0	12.9	0	12.0	0	22.0	0
74	0	40.0	16.9	0	34.2	0	10.2	0
75	10.7	30.0	16.8	0	11.5	0	23.5	0
76	6.1	30.0	13.5	0	14.9	0	11.8	0
77	0	40.0	15.3	0	12.3	0	26.3	0
78	37.5	20.0	14.3	0	14.7	0	16.9	0
79	0	38.9	39.3	0	11.1	0	19.1	0
80	19.8	30.0	14.5	0	13.4	0	19.2	0
81	0	40.0	12.0	4.3	11.8	0	42.3	0
82	33.9	30.0	7.7	0	11.8	0	17.1	0
83	0	36.6	12.2	0	13.7	0	22.9	0
84	21.0	20.0	10.5	0	10.7	0	17.6	0
85	0	40.0	12.8	0	14.3	0	12.8	10.0
86	28.3	20.0	12.1	0	24.9	0	14.2	0
87	28.6	30.0	10.5	0	8.7	0	24.7	0
88	108.0	21.6	9.5	0	9.3	0	13.6	0
89	44.1	5.2	19.7	0	6.9	0	16.6	0
90	19.6	13.5	23.5	0	13.4	0	11.2	0
91	3.3	24.5	16.3	0	9.6	0	17.7	0
92	23.3	0	18.0	0	17.5	0	13.8	0
93	0	37.9	21.3	0	15.7	0	14.7	0
94	51.1	4.7	8.9	0	13.7	0	18.3	0
95	8.9	19.9	15.8	0	28.5	0	24.1	0
96	2.8	30.0	20.5	0	11.9	0	8.3	0
97	17.3	30.0	14.2	0	14.8	0	16.7	0
98	8.2	20.0	17.5	0	14.4	0	16.1	0
99	0	31.2	12.4	3.3	11.8	0	13.7	0
100	32.6	30.0	6.1	0	9.8	2.1	10.2	0
101	3.1	29.3	17.1	0	9.4	0	8.6	0
102	14.8	30.0	17.9	0	8.8	0	11.3	0
103	58.6	20.0	19.5	0	8.5	0	18.3	0
104	21.3	28.0	29.8	3.6	11.9	0	34.6	0
105	0	40.0	14.0	0	8.0	0	10.7	0
106	36.1	20.0	19.3	0	21.7	0	20.1	0
107	50.0	24.9	20.0	6.6	10.2	0	17.8	0
108	12.0	20.0	10.8	5.2	10.0	0	25.5	0
109	0	30.5	7.5	8.2	10.1	0	19.6	0

110	0	42.7	10.4	0	13.0	1.9	11.8	0
111	22.9	6.5	11.1	0	14.4	0	12.3	0
112	0	39.5	14.8	0	15.8	0	18.5	0
113	22.3	20.0	15.9	0	17.0	0	8.8	0
114	21.8	20.0	11.7	0	23.4	0	27.8	0
115	20.9	27.3	14.1	0	12.9	0	22.3	0
116	19.9	20.0	12.6	0	14.1	0	8.2	0
117	5.6	27.1	16.0	0	12.5	0	11.8	0
118	103.0	7.1	8.1	0	9.1	0	6.3	0
119	12.1	27.5	17.5	0	19.8	0	33.4	0
120	23.2	18.1	14.6	0	9.5	0	6.3	0
121	0	37.0	9.8	0	8.5	0	13.6	0
122	12.0	1.3	9.2	0	7.9	0	6.6	0
123	0	32.5	10.1	0	6.5	0	6.3	0
124	3.0	24.1	15.9	0	15.3	0	6.8	0
125	25.4	5.7	12.4	0	12.1	0	12.6	0
126	12.8	26.7	14.0	0	11.7	0	25.7	0
127	21.8	7.7	17.5	0	12.2	0	17.0	0
128	6.9	38.8	23.6	0	20.2	0	22.6	0
129	0	29.7	9.8	0	11.9	0	7.4	0
130	17.1	9.9	9.7	0	6.5	0	6.7	0
131	0	42.4	11.6	0	11.3	0	12.7	0
132	18.1	17.2	12.8	0	10.9	0	9.7	0
133	0	40.9	10.0	0	9.3	0	10.9	0
134	13.2	0	8.9	0	9.8	0	9.8	0
135	0	40.3	11.1	0	10.1	0	6.1	0
136	8.6	17.9	10.8	0	10.0	0	6.3	0
137	9.1	29.7	9.3	0	9.7	0	11.0	0
138	18.1	9.5	10.5	0	6.8	0	9.7	0
139	7.0	25.4	7.9	0	8.4	0	5.6	0
140	15.2	14.9	11.2	0	14.1	0	28.1	0
141	7.2	19.2	12.7	0	8.9	0	5.3	0
142	18.7	9.9	8.2	0	8.0	0	5.9	0
143	0	30.1	12.8	0	10.9	0	10.0	0

Post-laboratory

144	30.1	0	12.9	0	8.8	0	7.5	0
145	0	24.9	11.1	0	10.9	0	9.5	0
146	0	27.3	5.8	9.2	7.7	0	8.6	0
147	13.5	20.0	24.1	0	9.8	0	10.3	0
148	16.1	13.0	30.4	0	11.6	0	7.2	0
149	21.0	18.4	11.3	0	18.7	0	10.5	0
150	19.8	20.0	7.8	0	7.4	0	8.4	0
151	0	14.2	13.0	0	10.9	0	11.9	0
152	0	37.3	11.9	0	9.6	0	10.5	0
153	9.3	0	8.9	0	9.8	0	9.3	0
154	0	25.5	7.9	0	7.3	0	7.5	0
155	16.6	0	9.9	0	6.8	0	10.2	0
156	0	40.0	10.0	0	5.7	0	8.1	0
157	12.7	0	10.5	0	6.9	0	7.0	0

158	0	37.8	11.0	0	10.4	0	12.9	0
159	10.0	19.2	9.8	0	12.3	0	9.6	0
160	12.7	24.6	10.7	0	10.1	0	6.1	0
161	0	39.2	11.7	0	10.2	0	6.9	0
162	29.1	10.0	11.1	0	9.8	0	9.7	0
163	9.6	30.0	13.4	0	14.9	0	40.5	0
164	7.8	22.6	8.4	0	9.5	0	7.5	0
165	16.3	30.0	14.7	0	5.9	0	4.8	0
166	30.4	20.0	7.0	0	8.4	0	6.7	0
167	10.3	30.0	13.7	0	13.4	0	16.3	0
168	22.0	16.7	9.7	0	12.0	0	9.2	0
169	0	40.0	8.8	5.1	9.0	0	5.3	0
170	11.4	0	9.2	0	7.4	0	5.4	0
171	0	40.0	11.8	0	6.4	0	8.4	0
172	33.9	0	6.2	0	14.3	0	6.3	0
173	0	40.0	46.9	0	11.6	0	11.3	0
174	60.7	0	9.3	0	15.5	0	7.1	0

APPENDIX E
DATA FOR SUBJECT TM

Laboratory and non-laboratory data for subject TM. Laboratory data are calculated in mean responses/minute/session with total session duration as the denominator in Phase 1 and cumulative latency from sample to comparison responses in Phases 2, 3, & 4. Non-laboratory data are presented with total latencies for correct and incorrect responses across all four stimuli separated with respect to each procedure (Look-Say, Listen-Find, Look-Find, and Listen-Say).

APPENDIX E

DATA FOR SUBJECT TM

Laboratory

	Comparisons (1) C	(1) IC	(2) C	(2) IC
Session				
Phase 1.				
1	1.2	00.0	----	----
2	3.0	00.0	----	----
3	2.4	00.0	----	----
4	3.0	00.0	----	----
5	4.8	00.0	----	----
6	3.0	00.0	----	----
Phase 2.				
1	.6	2.4	24.0	18.0
2	6.0	18.0	48.0	30.0
3	30.0	5.4	36.0	6.0
4	00.0	4.2	54.0	00.0
5	30.0	3.6	48.0	00.0
6	24.0	00.	48.0	00.0
7	60.0	6.0	60.0	00.0
8	48.0	00.0	54.0	00.0
9	54.0	00.0	18.0	6.0
10	30.0	12.0	18.0	3.0
11	42.0	00.0	48.0	00.0
12	48.0	00.0	48.0	00.0
13	54.0	00.0	42.0	00.0
14	36.0	00.0	42.0	3.6
15	48.0	00.0	42.0	3.0
16	36.0	00.0	42.0	00.0
Phase 3.				
1	42.0	00.0	48.0	00.0
2	42.0	00.0	42.0	3.6

3	36.0	00.0	48.0	00.0
4	42.0	00.0	42.0	4.2
5	42.0	6.0	36.0	00.0
6	36.0	6.0	36.0	00.0
7	48.0	00.0	36.0	3.6
8	48.0	00.0	36.0	00.0
9	54.0	00.0	36.0	1.8
10	18.0	00.0	36.0	00.0
11	42.0	00.0	54.0	00.0
12	48.0	00.0	48.0	00.0

Phase 4.

1	48.0	00.0	18.0	6.0
2	54.0	00.0	30.0	3.0
3	54.0	00.0	30.0	00.0
4	48.0	00.0	24.0	1.2
5	60.0	00.0	24.0	00.0
6	42.0	00.0	30.0	00.0
7	18.0	00.0	18.0	6.0
8	18.0	00.0	18.0	6.0
9	42.0	00.0	18.0	4.2
10	48.0	00.0	24.0	1.8
11	36.0	00.0	18.0	5.4
12	42.0	00.0	12.0	2.4
13	54.0	00.0	102.0	18.0
14	48.0	00.0	30.0	00.0
15	30.0	00.0	18.0	5.4
16	48.0	00.0	30.0	00.0
17	42.0	00.0	30.0	00.0
18	30.0	00.0	30.0	00.0
19	48.0	00.0	18.0	00.0
20	42.0	00.0	12.0	3.6
21	36.0	00.0	18.0	6.0
22	30.0	00.0	18.0	.6
23	48.0	00.0	12.0	6.0
24	24.0	00.0	12.0	4.8
25	30.0	00.0	18.0	00.0
26	42.0	00.0	24.0	00.0
27	42.0	00.0	.6	5.4
28	30.0	00.0	24.0	00.0
29	30.0	00.0	18.0	2.4
30	36.0	00.0	30.0	00.0
31	30.0	00.0	18.0	4.2
32	36.0	00.0	18.0	6.0
33	42.0	00.0	18.0	4.2
34	36.0	00.0	24.0	4.8
35	42.0	00.0	24.0	3.6
36	42.0	00.0	18.0	3.0
37	42.0	00.0	24.0	5.4
38	42.0	00.0	24.0	1.8

39	36.0	00.0	24.0	3.6
40	42.0	00.0	24.0	6.0
41	42.0	00.0	24.0	4.2
42	48.0	00.0	24.0	4.8
43	42.0	00.0	30.0	3.0
44	----	----	24.0	1.8

Pre-laboratory

	Look-Say		Listen-Find		Look-Find		Listen-Say	
Session #	C	IC	C	IC	C	IC	C	IC
1	0	30.9	7.5	1.0	3.9	6.7	4.1	0
2	6.5	3.3	4.8	1.8	6.1	0	4.6	0
3	1.0	14.7	4.1	9.1	4.8	8.0	7.3	0
4	1.5	18.3	4.8	5.5	8.0	3.1	7.5	0
5	1.5	17.8	6.9	6.2	10.0	4.4	12.5	0
6	4.8	1.3	12.2	6.2	6.8	3.2	9.4	0
7	5.6	23.0	8.9	3.1	2.6	1.0	7.7	0
8	0.7	5.1	1.3	9.3	0.9	10.6	3.6	0
9	1.7	14.2	5.4	6.5	5.7	8.0	6.3	0
10	5.7	20.0	5.7	8.9	6.2	0	8.9	0
11	0	8.2	2.5	5.8	5.1	0	5.1	0
12	1.6	7.0	1.6	5.3	3.6	3.1	2.3	0
13	1.0	9.8	0	7.9	8.9	2.4	6.0	0
14	0	17.4	3.1	2.0	0	9.4	3.4	0
15	1.0	4.8	3.3	8.8	3.1	6.2	3.3	0
16	1.2	6.6	0.9	11.5	0	13.7	4.0	0
17	6.5	18.4	5.0	7.6	9.1	0	6.9	0
18	2.7	1.8	3.9	2.2	6.0	3.9	4.7	0
19	3.8	8.5	6.9	10.0	5.3	5.1	10.5	0
20	2.5	6.5	9.4	9.3	6.6	2.0	9.8	0
21	1.1	3.6	0.8	4.8	7.5	3.2	5.6	0
22	1.6	4.0	4.0	7.8	6.1	8.0	5.7	0
23	1.5	12.5	5.0	6.1	5.9	9.1	4.7	0
24	1.6	6.1	6.6	1.6	6.7	4.7	7.4	0
25	1.7	6.7	9.0	12.8	10.9	8.9	5.9	0
26	2.9	9.5	3.2	9.3	1.4	6.2	10.9	0
27	4.5	7.2	3.6	15.0	6.4	10.0	16.4	0
28	7.5	4.7	1.2	11.9	2.5	11.2	5.4	0
29	1.6	3.3	1.1	11.5	4.7	0	6.0	0
30	3.3	3.5	4.7	1.3	3.2	4.2	5.4	0
31	2.2	4.1	7.2	13.6	6.1	6.9	6.9	0
32	2.0	4.9	4.8	6.5	2.7	4.9	3.6	0
33	1.4	4.8	8.0	8.9	7.4	2.3	9.0	0
34	1.9	5.2	5.4	0	2.7	3.8	9.6	0
35	0	6.4	6.2	4.0	3.4	2.6	6.4	0
36	3.0	13.0	9.8	3.7	3.1	5.5	8.4	0
37	3.3	3.5	6.2	7.0	4.7	6.8	4.6	0

38	2.4	3.1	1.9	8.5	6.8	5.2	9.4	0
39	3.2	4.2	7.2	2.1	8.1	0	4.4	0
40	1.1	10.3	9.5	2.0	19.4	0	7.2	0
41	12.0	2.0	10.1	2.3	8.4	2.6	8.3	0
42	1.6	4.2	8.0	5.6	11.3	0	3.9	0
43	6.6	4.6	9.7	0	9.5	0	9.9	0
44	5.1	7.8	5.0	0	6.2	0	8.4	0
45	2.2	3.1	13.5	10.0	7.5	0	12.1	0
46	6.4	0	11.5	0	9.8	0	13.1	0
47	4.2	1.6	9.5	0	13.0	0	10.1	0
48	2.5	2.9	7.2	0	6.6	0	9.5	0
50	0	8.2	10.0	0	7.6	0	12.5	0
51	1.6	12.4	4.6	16.7	13.4	10.1	14.6	0
52	2.5	5.3	4.4	4.2	4.7	0	14.1	0
53	3.1	3.1	6.8	0	8.5	0	7.0	0
54	3.0	3.8	6.9	0	4.7	0	7.4	0
55	4.7	7.6	7.3	2.3	5.4	0	11.1	0
56	2.8	8.0	2.5	3.6	7.0	0	5.9	0
57	1.8	4.2	5.4	0	6.5	0	6.8	0
58	4.1	6.6	11.3	3.6	4.8	3.0	7.2	0
59	4.2	8.2	3.8	3.1	6.7	0	6.0	0
60	1.7	9.5	5.1	0	13.3	0	3.4	0
61	5.6	1.1	4.1	2.4	6.4	3.5	4.2	0
62	2.2	7.2	4.2	1.5	8.3	0	6.8	0
63	1.1	10.2	3.3	1.2	4.1	5.4	6.6	0
64	4.7	4.3	12.7	0	4.9	2.3	11.1	0
65	1.0	5.6	5.9	1.5	3.4	3.9	5.8	0
66	4.1	1.2	3.5	3.3	3.9	3.9	4.6	0
67	1.1	8.3	4.2	3.0	5.2	2.0	4.4	0
68	2.7	3.8	5.0	2.1	10.1	0	3.5	0
69	2.0	2.6	2.3	4.2	18.0	0	7.0	0
70	2.9	4.1	5.9	2.3	10.5	0	3.1	0
71	10.9	0	5.5	1.8	4.2	4.6	3.7	0
72	11.1	0	6.0	1.5	4.8	5.2	4.1	0
73	2.8	4.0	4.1	1.4	3.9	2.8	5.2	0
74	3.3	1.6	3.3	0	5.5	0	8.9	0
75	3.1	0.9	3.7	1.9	15.5	0	7.1	0
76	7.7	1.7	3.0	3.8	4.1	2.3	4.9	0
77	2.6	3.9	3.8	4.7	10.1	0	4.8	0
78	2.3	3.8	2.4	7.0	4.5	0	3.8	0
79	2.1	8.2	6.3	3.0	7.5	0	4.7	0
80	2.4	3.3	3.7	1.7	5.5	4.3	5.0	0
81	1.6	5.8	2.4	3.4	5.2	2.7	6.3	0
82	4.0	1.6	4.1	1.4	4.4	0	9.2	0
83	6.3	6.7	6.1	1.4	10.7	0	9.0	0
84	4.7	1.5	4.2	1.7	6.6	0	4.7	0
85	1.3	7.4	3.2	1.7	4.3	2.7	6.0	0
86	1.3	5.3	7.1	0	7.0	0	7.7	0
87	0	7.7	6.8	0	9.0	0	9.8	0
88	2.5	3.4	3.4	1.0	6.2	0	5.4	0
89	2.2	2.6	4.1	3.6	5.4	0	6.1	0

90	1.1	5.6	3.5	1.0	5.0	0	9.4	0
91	3.0	2.2	3.0	0	4.7	0	4.8	0
92	8.6	2.2	4.9	0	3.8	0	6.6	0
93	1.1	8.3	3.0	1.9	5.3	0	3.9	0
94	1.7	9.5	3.2	0	5.5	0	11.3	0
95	5.9	1.0	5.3	0	4.9	0	6.6	0
96	4.2	0.9	2.2	2.5	4.6	0	3.8	0
97	6.0	4.2	3.4	2.0	5.7	0	6.5	0
98	6.5	3.7	3.4	1.2	4.9	0	5.1	0
99	2.3	3.2	3.0	1.8	3.8	2.6	3.9	0
100	2.8	1.2	3.4	1.6	5.3	0	6.0	0
101	2.6	2.9	4.2	2.2	7.6	0	5.6	0
102	1.1	3.7	3.3	2.4	4.7	0	3.6	0
103	4.0	2.5	2.6	1.1	4.6	0	5.4	0
104	2.5	3.0	2.0	5.5	2.9	1.7	3.9	0
105	3.9	0.9	2.8	1.5	7.6	0	3.4	0
106	4.8	1.0	3.5	0	6.1	0	4.1	0
107	3.9	1.0	4.2	1.1	6.0	0	5.3	0
108	1.8	2.5	3.1	1.9	9.3	1.7	5.3	0
109	0.9	6.1	3.3	3.0	7.3	0	3.1	0
110	1.4	2.5	2.9	5.4	5.1	0	3.1	7.0
111	2.7	5.8	5.5	4.2	7.3	0	3.6	0
112	5.5	4.8	2.9	2.1	7.6	1.1	5.6	0

<u>During-laboratory</u>

151	8.4	17.7	9.8	7.6	4.9	0	5.0	0
152	0	39.4	6.1	0	9.4	0	5.4	0
153	36.7	20.0	25.2	0	5.8	0	3.2	0
154	64.0	11.3	6.0	0	5.4	0	7.1	0
155	7.4	3.1	13.3	0	8.4	0	5.3	0
156	10.9	18.3	12.6	0	5.8	0	3.1	0
157	12.7	10.0	20.2	0	9.6	0	9.0	0
158	10.8	10.0	10.9	0	7.9	0	8.3	0
159	5.2	17.3	5.9	1.8	13.2	0	5.1	0
160	29.5	2.3	12.9	0	9.7	0	4.5	0
161	9.8	10.0	9.7	0	5.3	0	4.3	0
162	7.8	2.8	6.4	0	5.8	0	5.5	0
163	8.4	1.7	9.4	0	9.7	0	4.9	0
164	0	25.6	3.2	23.0	6.0	0	6.5	0
165	1.5	15.6	19.1	2.0	10.1	0	25.9	0
166	6.1	23.3	6.1	3.9	6.0	0	3.6	0
167	1.4	20.9	3.5	4.9	7.0	0	4.2	0
168	9.9	8.8	6.6	3.0	5.6	0	3.6	0
169	20.2	15.2	23.0	0	9.1	0	3.8	0
170	5.1	1.9	20.0	19.6	10.5	0	6.9	0
171	7.4	2.3	9.2	3.7	9.0	0	3.3	0
172	1.6	15.1	7.8	6.8	8.2	0	3.3	0
173	2.0	12.4	15.9	0	8.7	0	3.8	0
174	4.1	26.6	10.4	4.7	7.5	0	7.5	0
175	1.6	11.6	5.9	8.1	9.7	0	3.5	0

176	6.1	15.0	5.3	0	7.2	0	3.1	0
177	2.5	16.4	9.5	1.7	10.7	0	3.9	0
178	2.0	20.5	15.1	0	8.6	8.2	3.1	0
179	6.8	2.4	2.4	13.0	5.8	0	4.2	0
180	2.0	20.5	5.4	0	8.0	0	3.1	0
181	4.4	20.0	4.1	6.4	8.5	0	5.3	0
182	6.1	5.2	2.4	9.3	11.3	0	4.4	0
183	3.0	3.9	14.2	7.2	10.7	0	4.7	0
184	8.6	9.1	8.4	0	7.3	0	3.7	0
185	10.4	6.2	11.3	10.6	8.5	0	3.3	0
186	3.0	18.1	10.6	0	7.8	0	3.8	0
187	9.8	6.3	9.0	8.6	9.6	0	4.8	0
188	17.7	3.2	11.4	12.7	7.3	0	4.6	0
189	10.8	17.9	36.7	0	23.6	0	3.4	0
190	14.8	0	38.5	0	7.9	0	3.8	0
191	3.8	6.7	53.9	0	10.4	0	3.9	0
192	49.8	8.0	13.0	6.6	12.3	0	19.5	0
193	1.9	16.5	15.9	3.5	5.7	0	5.5	0
194	6.9	6.7	12.7	1.6	6.8	0	5.7	1.1
195	21.2	0	21.5	1.8	8.3	0	3.2	0
196	31.6	0	22.0	0	15.4	0	3.1	0
197	0	121.5	6.4	0	26.2	0	6.9	0
198	1.4	34.3	8.9	2.0	6.7	0	3.3	0
199	3.0	32.0	21.5	0	6.8	0	3.5	0
200	34.8	11.8	22.4	0	6.5	0	17.0	0
201	9.9	48.5	18.1	2.2	5.5	0	2.6	0
202	3.4	7.9	12.2	0	6.5	0	2.9	0
203	10.2	25.7	4.1	4.4	7.3	0	3.2	0
204	1.4	9.6	9.8	9.5	8.0	0	3.3	0
205	7.2	20.0	8.1	3.7	5.8	0	3.3	0
206	2.0	14.3	14.3	2.5	5.2	0	4.4	0
207	1.1	14.4	6.3	8.5	4.7	0	3.0	0
208	20.3	7.2	2.8	10.9	6.7	0	3.3	0
209	4.6	12.7	13.5	5.2	4.6	0	3.3	0
210	7.3	5.9	10.1	7.4	4.0	0	3.3	0
211	5.3	1.7	16.7	0	4.5	0	3.1	0
212	10.0	6.3	6.8	6.4	6.7	0	4.0	0
213	5.6	10.0	9.1	2.0	5.2	0	3.2	0
214	2.4	27.5	9.2	0	8.0	0	3.9	0
215	2.4	24.7	9.7	0	5.0	0	4.3	0
216	2.7	26.3	12.9	0	5.0	0	4.6	0
217	6.6	4.2	8.7	0	7.3	0	3.5	0
218	7.7	10.0	7.4	4.1	5.8	0	4.1	0
219	3.3	1.8	8.8	0	5.4	0	3.2	0
220	5.9	3.8	7.4	3.4	4.4	0	2.3	0
221	12.4	4.3	6.4	0	4.8	0	2.9	0
222	5.1	3.1	4.2	4.1	4.7	0	2.9	0
223	3.5	7.0	0	8.6	9.5	0	3.3	0
224	2.6	5.1	5.6	2.2	10.6	0	2.9	0
225	1.6	7.0	5.5	2.4	3.2	0	2.6	0

<u>Post-laboratory</u>

225	2.6	15.7	4.7	9.0	6.8	0	3.7	0
226	1.6	10.4	2.9	8.9	4.3	0	2.8	0
227	9.0	3.9	3.0	17.6	4.1	0	3.8	0
228	2.0	7.3	10.6	6.7	3.9	0	3.7	0
229	6.1	6.3	22.0	0	6.5	0	5.0	0
230	10.0	19.5	1.6	11.3	4.4	0	3.3	0
231	1.4	6.8	9.1	0	5.4	0	5.4	0
232	8.4	4.6	10.6	0	4.1	0	3.9	0
233	2.1	26.8	6.0	8.5	4.3	0	3.5	0
234	2.6	9.3	10.3	0	4.8	0	3.3	0
235	7.2	2.4	6.3	5.3	4.5	0	3.2	0
236	1.8	16.2	10.5	4.8	6.1	0	3.2	0
237	1.3	17.3	9.2	4.2	5.4	0	4.1	0
238	5.4	7.4	14.7	0	6.4	0	3.1	0
239	3.0	8.6	8.6	0	5.5	0	5.6	0
240	4.6	7.0	10.3	0	6.5	0	4.0	0
241	12.5	10.0	8.9	0	8.4	0	5.7	0
242	2.1	14.7	9.0	0	6.6	0	7.0	0
243	7.5	2.8	7.9	10.1	7.3	0	4.1	0
244	4.0	11.6	18.7	0	7.5	0	4.6	0
245	3.6	20.0	6.6	3.9	6.5	0	4.9	0
246	2.9	14.6	3.5	9.3	8.2	0	5.3	0
247	0	33.6	18.2	6.5	6.9	0	22.2	0
248	4.5	16.8	6.3	7.1	5.7	0	4.8	0
249	0	22.4	0	29.9	23.2	0	21.1	0
250	0	22.6	1.8	13.8	8.2	0	12.6	3.7
251	0	23.8	5.0	1.9	6.8	0	3.0	0
252	5.6	2.4	2.8	4.0	6.7	0	4.5	0
253	1.6	24.5	29.8	10.0	8.2	0	13.7	0
254	0	31.9	5.3	10.0	6.8	0	11.5	0
255	1.9	21.8	1.3	12.4	7.6	0	6.5	0
256	3.6	23.5	12.4	4.4	12.1	0	16.0	0
257	0	29.3	11.9	0	4.1	0	3.4	0
258	5.6	9.3	13.9	0	3.7	0	3.3	0
259	9.7	11.7	10.6	6.1	5.1	0	4.1	0
260	20.5	4.1	1.9	19.7	6.7	0	4.9	0
261	2.4	7.2	11.7	0	4.0	0	3.5	0
262	0	15.6	10.1	3.1	4.3	0	3.0	0
263	1.8	7.4	4.3	0	4.7	0	3.2	0
264	4.3	10.0	3.6	8.5	4.5	0	2.7	0
265	4.9	24.0	12.6	6.9	2.9	0	2.6	0
266	11.8	3.5	10.7	10.7	3.3	0	3.2	0
267	7.4	4.1	8.0	0	9.0	0	3.8	0
268	10.7	0	13.7	0	5.8	0	3.7	0
269	3.5	13.1	9.2	0	7.0	0	4.3	0
270	7.2	14.0	12.4	0	8.4	0	4.0	0
271	5.6	2.0	12.0	0	6.0	0	3.5	0
272	1.9	13.4	4.5	4.1	6.0	0	4.2	0
273	3.4	13.5	5.1	6.2	5.2	0	3.9	0

274	5.9	4.1	6.1	4.9	6.3	0	3.6	0
275	34.6	0	24.7	0	5.7	0	7.2	0
276	7.1	20.0	14.2	0	6.0	0	4.7	0
277	0	20.4	7.2	2.6	5.9	0	5.7	0
278	60.8	0	12.7	5.0	6.9	0	4.6	0
279	0	24.8	2.1	19.4	7.4	0	5.1	0
280	3.8	7.4	1.9	13.4	5.8	0	4.4	0
281	20.6	18.8	16.3	0	5.7	0	8.8	0
282	1.3	25.0	14.7	0	5.1	0	5.2	0
283	6.8	2.9	11.6	0	4.9	0	2.7	0
284	3.2	23.0	9.5	4.9	6.2	0	12.9	0
285	85.1	0	10.6	5.0	5.1	0	7.0	0
286	4.2	20.0	8.9	0	5.9	0	3.4	0
287	1.3	17.2	5.4	4.1	5.5	0	4.2	0
288	1.2	16.5	12.0	0	6.6	0	3.6	0
289	10.5	11.2	6.5	2.4	6.2	0	4.2	0
290	10.4	20.0	7.0	4.9	5.8	0	4.5	0
291	6.0	11.6	4.7	6.0	4.4	0	4.8	0
292	2.9	15.2	6.4	3.0	5.4	0	5.0	0
293	4.3	16.8	13.9	0	6.5	0	3.8	0
294	4.8	30.0	5.3	5.8	5.1	0	4.4	0
295	5.6	17.9	8.7	0	5.5	0	8.7	0
296	9.8	12.3	5.0	7.4	6.4	0	4.1	0
297	29.6	10.0	21.5	0	6.7	0	3.7	0
298	0	24.6	4.7	6.3	6.2	0	4.5	0
299	10.4	19.9	12.8	0	6.4	0	3.8	0
300	8.1	0	16.0	0	7.1	0	6.1	0
301	3.4	7.8	8.7	4.1	21.5	0	12.5	0
302	6.4	20.0	14.2	6.3	17.9	0	6.3	0
383	31.2	10.0	13.0	4.1	30.3	0	18.5	0

APPENDIX F
DATA FOR SUBJECT KD

Laboratory and non-laboratory data for subject KD. Laboratory data are calculated in mean responses/minute/session with total session duration as the denominator in Phase 1 and cumulative latency from sample to comparison responses in Phase 2. Non-laboratory data are presented with total latencies for correct and incorrect responses across all four stimuli separated with respect to each procedure (Look-Say, Listen-Find, Look-Find, and Listen-Say).

APPENDIX F

DATA FOR SUBJECT KD

Laboratory

	Comparisons (1)		Comparisons (2)	
Session	C	IC	C	IC
Phase 1.				
1	4.2	00.0	----	----
2	4.2	1.2	----	----
3	3.6	.6	----	----
4	.6	.6	----	----
Phase 2.				
1	31.2	8.4	12.0	27.0
2	42.0	6.0	16.8	11.2
3	36.0	6.0	16.1	14.7
4	54.0	36.0	10.3	11.4
5	18.0	6.0	37.7	48.0
6	48.0	00.0	27.5	25.0
7	30.0	30.0	25.6	28.1
8	42.0	4.2	11.8	18.0
9	30.0	00.0	30.0	17.1
10	36.0	00.0	6.8	11.0
11	30.0	00.0	13.5	23.3
12	54.0	12.0	21.6	19.0
13	18.0	00.0	18.0	8.8
14	42.0	00.0	6.8	23.4
15	.6	00.1	1.0	1.6
16	30.0	0.00	18.6	18.4
17	18.0	0.00	9.8	18.8
18	18.0	00.0	3.8	3.7
19	48.0	00.0	11.8	16.5
20	36.0	00.0	18.0	18.0
21	24.0	3.6	22.7	15.8
22	36.0	00.0	25.2	18.3
23	30.0	5.4	18.4	18.0

24	24.0	12.0	12.5	17.2
25	24.0	4.2	18.0	21.6
26	30.0	00.0	23.0	00.0
27	30.0	12.0	2.8	15.5
28	42.0	00.0	17.1	18.0
29	36.0	00.0	1.5	5.3
30	36.0	00.0	11.0	15.3
31	18.0	3.6	12.0	20.0
32	36.0	4.8	9.4	15.3
33	24.0	3.6	1.0	.1
34	36.0	00.0	23.1	18.0
35	96.0	00.0	12.0	23.0
36	42.0	00.0	23.0	16.4
37	30.0	4.8	18.2	18.2
38	36.0	00.0	15.0	21.4
39	42.0	00.0	3.8	23.7
40	30.0	4.8	27.0	19.0
41	42.0	00.0	14.0	14.0
42	42.0	00.0	28.0	14.1
43	42.0	00.0	4.7	3.2
44	42.0	00.0	5.0	.1
45	42.0	00.0	16.5	24.5
46	42.0	00.0	11.0	30.0
47	48.0	00.0	27.5	21.0
48	48.0	00.0	15.0	30.0
49	36.0	00.0	30.0	16.0
50	42.0	00.0	15.3	22.2
51	48.0	00.0	20.1	20.1
52	30.0	4.8	2.3	38.3
53	36.0	00.0	3.6	29.4
54	42.0	00.0	16.7	16.5
55	24.0	3.0	8.0	24.0
56	24.0	6.0	12.0	22.0
57	36.0	00.0	17.1	24.0
58	36.0	00.0	26.3	17.0
59	30.0	00.0	19.5	17.0
60	18.0	30.0	17.4	23.0
61	12.0	24.0	11.0	25.0
62	42.0	00.0	25.4	13.0
63	42.0	0.08	17.3	00.0
64	24.0	00.0	21.4	21.4
65	42.0	00.0	26.3	15.0
66	12.0	4.8	7.5	23.0
67	24.0	00.0	15.1	18.1
68	30.0	4.8	22.2	16.0
69	48.0	00.0	19.6	17.6
70	18.0	6.0	25.0	21.3
71	18.0	00.0	15.0	24.0
72	42.0	00.0	6.7	35.0
73	42.0	00.0	.3	41.0
74	54.0	00.0	15.3	.7

75	48.0	00.0	15.6	1.7
76	42.0	00.0	3.6	53.2
77	42.0	00.0	16.1	21.4
78	30.0	00.0	12.0	27.4
79	42.0	00.0	9.9	31.7

Pre-laboratory

	Look-Say		Listen-Find		Look-Find		Listen-Say	
Session #	C	IC	C	IC	C	IC	C	IC
1	3.7	6.0	3.2	1.0	11.7	3.4	0.8	2.9
2	2.3	8.6	6.8	1.1	7.0	1.8	2.5	1.0
3	4.2	4.8	2.4	3.2	9.6	3.7	3.7	0
4	5.0	1.7	3.9	5.6	6.9	0	4.1	0
5	2.0	6.3	4.4	1.7	7.7	1.2	3.7	0
6	3.1	4.7	6.8	7.1	5.5	1.5	3.8	0
7	5.3	4.4	2.7	4.1	8.6	10.0	3.6	0
8	6.5	8.3	7.3	1.4	14.0	3.4	4.4	0
9	0	9.1	3.5	1.0	13.4	4.1	4.6	0
10	3.3	3.5	3.0	2.1	5.2	2.6	3.8	0
11	2.6	3.2	5.3	1.2	3.5	9.2	4.4	0
12	4.5	6.8	5.2	1.1	3.3	3.2	4.0	0
13	3.2	3.4	6.0	0	4.2	4.0	4.6	0
14	2.8	4.2	3.7	1.7	6.5	1.1	4.4	0
15	2.2	3.7	1.3	3.7	0	5.4	2.8	0
16	3.2	5.5	5.2	3.2	7.4	4.2	2.0	0
17	2.1	8.9	0.9	5.0	5.4	4.6	2.9	0
18	3.1	3.8	4.6	3.1	14.5	3.1	3.3	0
19	1.6	7.8	8.9	1.5	0	8.3	4.0	0
20	3.1	5.2	0	6.8	3.1	4.2	3.8	0
21	4.5	2.7	1.3	4.9	2.6	6.5	3.3	0
22	0	7.1	5.6	4.0	8.3	5.1	4.6	0
23	1.2	5.9	9.4	6.5	3.6	7.3	4.6	0
24	1.2	4.2	5.0	4.1	9.0	0	5.0	0
25	1.3	7.9	5.9	3.0	1.4	6.9	4.6	0
26	6.8	4.1	6.8	0	9.8	0	5.1	0
27	1.4	4.4	1.4	6.9	5.5	3.2	4.1	0
28	3.0	4.6	4.9	1.6	12.1	0	4.9	0
29	1.1	5.4	3.8	3.3	8.7	0	3.7	0
30	1.3	4.0	1.2	4.5	5.0	1.5	2.7	0
31	1.5	5.1	1.7	6.1	3.7	3.1	3.9	0
32	3.1	3.2	5.8	3.5	4.3	1.3	4.0	0
33	3.9	2.7	1.4	5.6	6.0	0	4.3	0
34	1.2	3.5	3.0	3.8	8.0	0	3.4	0
35	1.7	5.5	3.0	2.8	6.7	1.6	4.1	0
36	1.3	4.0	2.8	6.5	4.6	4.1	4.1	0
37	0	8.4	1.9	6.5	9.9	0	4.0	0
38	3.5	4.9	1.5	6.2	5.0	1.9	4.1	0

39	3.7	3.7	10.4	2.7	12.1	0	3.9	0
40	1.6	5.0	3.1	3.1	4.2	4.4	3.5	0
41	2.9	3.5	3.9	3.9	11.8	1.5	3.8	0
42	0	5.2	3.1	3.2	5.6	1.4	3.6	0
43	1.3	4.8	1.2	6.0	3.7	2.8	3.0	0
44	1.9	5.7	1.2	3.9	1.3	6.2	3.3	0
45	1.0	5.9	3.2	5.7	4.8	4.1	3.3	0
46	2.1	5.2	3.4	4.5	8.7	0	3.6	0
47	0	6.4	3.9	3.0	3.8	6.6	3.3	0
48	1.4	4.8	4.8	2.3	4.0	5.2	3.2	0
49	0	6.6	1.0	8.9	3.1	3.9	2.9	0
50	1.5	3.7	4.2	1.9	3.1	4.1	3.4	0
51	2.1	3.1	2.1	2.2	3.4	2.9	3.6	0
52	1.8	4.8	2.8	3.1	4.3	1.3	3.0	0
53	1.7	5.9	2.3	3.0	5.0	2.2	3.1	0
54	0.6	2.4	4.0	1.6	0	7.2	2.6	0
55	0	4.0	3.6	1.5	2.2	3.7	2.9	0
56	0.9	5.7	5.3	1.6	4.4	5.1	2.4	0
57	0	5.7	3.1	2.5	4.8	4.8	3.7	0
58	2.5	11.3	3.6	4.3	11.7	3.9	1.9	0
59	0	17.7	9.2	2.2	3.8	4.9	2.6	0
60	10.2	5.7	5.1	4.1	6.4	2.0	2.9	0
61	0	6.6	0	4.9	5.0	5.1	1.9	0
62	0	5.7	3.5	3.7	1.3	6.9	2.0	0.6
63	1.8	6.8	4.1	3.3	9.7	2.1	3.6	0
64	4.5	6.3	1.4	4.1	6.2	2.1	3.0	0
65	1.2	4.0	1.5	4.9	4.3	3.9	3.6	0
66	2.0	6.3	5.8	6.3	12.4	2.9	3.4	0
67	1.0	7.2	4.6	1.2	6.4	3.5	2.6	0
68	0	9.7	1.2	9.5	5.6	1.6	2.5	0
69	1.4	5.6	2.5	6.4	5.8	4.3	3.0	0
70	0	4.4	1.2	5.6	5.7	1.6	3.6	0
71	0	8.4	1.5	4.5	4.7	1.7	1.8	2.9
72	0	7.3	1.8	3.7	5.4	3.5	3.9	0
73	0	5.0	3.1	3.2	4.7	3.5	3.9	0
74	0	10.6	1.8	6.2	4.3	3.6	9.4	0
75	1.3	3.2	2.4	3.4	3.9	3.9	3.7	0
76	0	12.2	7.6	4.0	5.8	2.3	3.7	0
77	0.9	2.6	0.9	3.3	114	4.5	2.0	0
78	0.8	4.4	2.8	2.7	1.5	5.1	3.4	0
79	0	10.2	3.3	4.3	5.7	1.8	4.3	0
80	0.9	7.3	4.3	1.8	3.4	3.8	2.1	1.1
81	4.7	5.0	4.3	3.6	7.2	1.6	1.3	1.9
82	6.4	0	3.9	4.0	10.3	0	2.9	0
83	2.6	2.5	1.6	4.4	1.4	6.9	2.9	0
84	2.4	2.6	0	5.8	1.3	5.3	2.3	0
85	2.1	2.3	3.3	3.1	2.8	3.3	2.6	1.7
86	2.9	2.6	1.3	2.8	8.3	2.8	3.2	0
87	2.8	2.3	0.8	4.4	8.1	1.6	4.2	0
88	3.2	2.9	6.4	1.6	7.0	1.6	3.6	0
89	0	10.0	2.1	4.8	4.7	1.5	3.7	0

90	5.4	1.2	1.8	3.5	5.0	5.1	3.3	0
91	3.2	3.2	1.3	5.8	7.7	2.3	2.9	0
92	0	10.1	10.1	0	5.7	1.4	3.3	0
93	0	15.2	4.8	2.5	5.9	2.3	2.3	0
94	0	7.4	1.3	14.7	6.6	1.6	2.5	0
95	1.4	6.1	3.1	2.3	5.3	3.1	2.7	0
96	1.7	7.5	5.2	4.0	9.5	0	1.9	0
97	1.2	3.9	2.4	16.0	14.1	3.6	3.0	0
98	2.4	2.7	5.1	10.9	8.9	0	2.0	0
99	8.0	1.2	7.4	2.2	8.2	3.4	3.6	0
100	1.1	10.8	7.5	2.0	7.7	2.3	3.5	0
101	1.6	5.3	3.9	6.4	2.8	5.9	3.4	0
102	1.3	3.9	2.1	4.6	3.2	3.5	3.1	0
103	0	17.9	6.0	6.7	8.2	2.7	3.0	0
104	2.0	2.1	2.3	2.6	2.8	5.3	0.9	3.4
105	0.5	9.1	4.1	2.7	7.3	0	2.8	0
106	0	5.4	3.6	2.0	5.7	1.6	2.6	0
107	4.7	2.5	8.2	0	6.3	8.1	4.8	0
108	4.4	1.3	6.1	2.8	8.3	4.5	3.3	0
109	3.6	5.4	6.6	2.3	8.8	2.1	3.7	0
110	9.2	1.7	6.8	2.2	14.3	0	5.2	0
111	4.7	1.5	6.5	3.5	10.3	0	6.3	0
112	3.6	4.3	3.1	3.0	11.1	5.0	8.8	0
113	5.8	1.4	3.6	2.7	20.2	0	4.0	0
114	4.1	3.6	3.0	3.4	6.8	2.1	4.2	0
115	5.3	2.1	9.3	0	10.6	1.8	3.3	0
116	4.5	1.5	7.6	1.6	8.6	0	4.0	0
117	7.5	4.3	3.5	3.5	5.7	1.9	4.2	0
118	1.4	6.4	7.9	1.2	15.7	4.4	6.6	0
119	3.6	6.1	9.2	0	8.3	0	3.7	0
120	3.9	4.3	4.3	1.5	5.7	2.3	3.5	0
121	2.2	3.9	2.5	1.4	11.2	0	3.6	0
122	7.0	0	4.2	3.7	6.8	2.3	6.0	0
123	5.5	1.8	3.6	1.0	6.0	2.7	3.2	0
124	5.4	3.8	4.8	3.4	9.8	0	5.0	0
125	1.9	19.0	6.0	2.8	8.2	6.2	3.2	0
126	8.8	2.0	6.2	1.4	15.5	0	3.1	0
127	1.4	10.8	10.4	0	9.3	4.0	4.0	0
128	4.8	1.8	4.1	4.5	9.0	0	4.7	0
129	5.2	1.8	8.1	0	17.2	0	3.8	0
130	10.3	0	8.9	0	8.1	0	4.0	0
131	11.6	3.9	11.5	0	9.9	0	3.7	0
132	4.2	2.7	6.9	0	11.1	0	3.2	0
133	7.5	0	5.3	0	11.6	0	3.3	0
134	5.6	0	5.8	0	11.0	0	4.3	0
135	3.4	4.9	5.5	1.8	10.6	0	3.5	0
136	2.0	5.6	5.2	1.5	8.0	4.7	4.4	0
137	2.4	8.6	2.3	3.7	10.2	0	4.2	0
138	4.4	4.8	6.1	0	12.7	0	5.8	0
139	5.1	0	4.1	0	8.7	0	3.3	0
140	1.4	0	9.0	0	12.2	0	5.5	0

141	6.6	0	6.2	2.3	11.0	0	4.0	0
142	10.4	0	5.4	0	10.1	0	3.2	0
143	3.8	2.3	8.8	3.5	18.5	0	4.6	0
144	8.0	3.1	6.2	0	16.2	0	3.2	0
145	5.7	0	7.3	0	16.5	0	3.2	0
146	2.9	4.2	5.5	1.4	11.9	0	4.5	0
147	7.4	3.0	5.5	0	12.3	0	4.7	0
148	8.7	0	4.8	0	7.9	0	3.9	0
149	4.9	1.4	6.6	1.5	10.8	0	3.8	0
150	2.2	7.8	3.3	4.0	10.8	0	4.0	0
151	4.9	3.2	6.4	1.7	8.1	1.6	3.1	0
152	6.2	3.2	3.8	10.3	5.7	2.1	4.3	0
153	2.0	2.7	4.2	1.7	7.7	0	5.6	0
154	6.8	5.7	8.2	0	4.2	7.6	4.1	0
155	10.9	0	9.3	0	33.0	0	3.7	0
156	5.3	1.9	9.0	0	8.9	0	6.5	0
157	5.7	2.0	12.2	0	11.1	0	4.2	0
158	2.6	4.9	11.9	0	12.9	0	4.6	0
159	3.3	4.1	8.5	0	7.8	0	5.5	0
160	5.5	0	16.3	0	8.4	0	6.6	0
161	12.6	1.8	16.6	0	10.1	0	4.9	0
162	10.8	0	10.1	0	9.4	0	5.0	0
163	1.8	5.4	11.5	0	7.0	0	3.7	0
164	3.3	3.8	11.6	0	9.2	0	3.4	0
165	4.7	2.2	12.8	0	10.1	0	3.8	0
166	2.9	3.0	11.9	0	8.3	0	5.7	0
167	5.9	0	6.8	0	11.2	0	8.9	0
168	7.0	1.1	7.8	0	8.0	1.8	3.1	0
169	14.8	0	6.5	0	7.9	0	3.6	0
170	8.9	0	6.0	0	8.0	0	4.2	0
171	13.1	10.0	8.5	0	11.1	0	3.6	0
172	5.9	10.0	17.6	0	14.3	0	7.1	0
173	3.3	11.9	11.1	0	10.7	0	3.1	0
174	13.8	0	6.8	0	10.9	0	3.5	0
175	18.6	0	17.3	0	11.7	0	3.5	0
176	5.4	2.3	5.3	7.2	11.4	0	3.8	0

<u>During-laboratory</u>

177	14.7	10.0	4.2	0	5.8	1.6	2.9	0
178	21.8	0	6.1	0	13.9	0	4.1	0
179	20.1	10.0	8.4	0	12.7	0	4.0	0
180	3.7	1.9	3.2	2.2	13.4	0	4.3	0.9
181	1.4	12.5	7.3	0	9.2	0	2.4	1.0
182	5.3	10.0	6.9	0	6.4	0	6.9	0
183	1.2	10.8	6.8	0	8.4	0	5.0	0
184	6.6	0	5.9	0	7.5	0	3.7	0
185	11.5	3.7	4.2	2.4	7.3	0	3.2	0
186	7.1	2.4	6.4	0	7.2	0	4.6	0.4
187	15.2	0	5.6	0	6.8	0	9.9	0
188	2.8	10.7	6.1	0	3.7	3.5	8.7	0

189	6.7	1.8	10.1	0	8.9	2.0	6.0	0
190	7.4	7.4	6.4	0	7.2	0	5.6	0
191	16.1	0	7.9	0	4.8	2.8	6.0	0
192	5.4	3.9	10.2	0	7.8	0	14.7	1.1
193	9.1	0	7.5	0	4.5	2.7	5.5	0
194	7.1	0	11.6	0	11.2	0	7.0	0
195	7.1	0	7.8	0	6.0	1.7	6.1	0
196	4.5	4.0	6.1	0.9	7.4	0	5.5	0
197	6.1	4.9	4.3	2.0	13.1	0	5.1	0
198	11.5	0	5.4	0	7.9	0	6.1	0
199	3.9	11.1	8.9	0	10.9	0	4.4	1.8
200	5.9	0	5.7	0	12.5	0	4.7	0
201	6.2	4.1	6.3	0	5.6	2.1	4.8	0
202	9.2	0	6.5	0	10.4	0	4.6	0
203	4.9	1.9	9.8	0	10	0	5.0	0
204	5.0	1.6	9.9	0	10.4	0	4.5	0
205	11.5	1.6	7.8	0	8.4	5.0	4.6	0
206	5.2	2.0	9.9	0	10.8	0	6.5	0
207	10.4	0	7.3	0	9.8	1.0	6.2	0
208	8.2	1.3	9.7	0	9.9	0	5.3	0
209	11.8	1.9	9.9	0	9.1	0	4.8	0
210	10.3	0	9.2	0	7.3	2.0	7.5	0
211	2.8	4.3	7.4	2.6	9.0	0	10.0	0
212	7.9	3.4	5.7	5.3	6.0	4.1	5.9	0
213	5.7	4.1	4.1	3.0	9.7	1.8	7.6	0
214	13.1	0	9.7	0	10.3	0	5.2	0
215	9.8	0	9.3	0	10.7	0	4.4	0
216	9.6	0	9.8	0	9.9	0	6.4	0
217	12.8	0	8.0	1.9	9.6	0	4.2	0
218	15.8	0	12.6	0	7.6	2.0	5.0	0
219	11.0	0	8.0	0	17.7	0	6.2	0
220	6.5	0	8.8	0	9.7	0	8.1	0
221	7.7	0	5.7	0	8.4	2.5	6.0	0
222	13.4	0	8.3	0	8.6	0	4.2	0
223	9.4	0	4.7	2.2	26.1	0	4.2	0
224	5.8	3.3	4.1	2.6	6.8	1.3	5.3	0
225	10.1	1.9	4.5	0	7.7	0	4.6	0
226	10.6	0	10.7	0	5.8	1.1	6.5	0
227	8.2	1.1	9.0	0	4.9	2.5	4.8	0
228	11.9	0	8.3	0	11.2	0	4.7	0
229	10.0	0	8.1	2.8	6.6	0	7.6	0
230	3.4	2.5	8.4	0	9.4	0	6.6	1.6
231	2.9	4.9	3.0	3.3	6.3	5.5	3.2	0
232	2.9	2.4	4.9	1.4	6.4	4.3	3.5	0
233	5.5	4.3	7.6	0	16.0	0	4.3	0
234	13.1	0	9.0	0	9.6	0	4.6	0
235	19.5	0	9.2	0	8.0	0	6.7	0
236	11.0	0	8.3	0	6.4	2.2	3.9	0
237	1.8	6.1	5.4	0	5.3	0	3.6	0
238	1.2	5.0	6.9	0	4.4	0	3.0	0
239	3.4	3.2	4.7	4.2	5.9	0	3.5	0

240	5.2	0	7.4	0	5.4	0	3.3	0
241	4.1	2.5	4.3	1.6	6.7	0	.8	0
242	1.2	4.8	6.8	0	5.4	0	3.7	0
243	2.3	2.1	7.5	0	7.3	0	2.8	0
244	3.6	2.7	3.8	1.6	6.5	0	3.7	0
245	4.0	3.6	6.7	1.5	8.8	0	4.7	0
246	2.5	1.9	4.8	1.7	5.6	0	3.2	0
247	4.3	3.1	6.6	0	6.7	0	3.4	0
248	2.4	2.5	5.3	3.9	6.1	0	4.5	0
249	2.5	2.7	4.3	3.5	6.1	0	3.4	0
250	.8	2.7	8.0	0	5.9	0	3.0	0
251	2.5	1.7	5.0	1.7	6.1	0	3.4	0
252	7.3	4.2	8.8	0	5.5	0	4.2	0
253	4.4	4.6	10.8	0	14.1	0	3.5	0
254	2.0	1.7	5.3	1.3	5.9	0	3.2	0
255	3.1	1.0	4.6	2.5	4.8	0	2.9	0
256	1.4	3.7	6.2	0	6.5	0	2.7	0
257	1.1	3.2	4.8	2.2	4.0	1.2	3.0	0

<u>Post-laboratory</u>

258	0	8.8	3.1	3.4	5.8	1.4	3.2	0
259	1.5	3.9	5.3	1.8	4.4	0	2.6	0
260	0.8	4.8	5.5	2.3	2.7	2.9	4.3	0
261	3.3	3.0	3.1	3.2	4.8	0	3.2	0
262	2.0	2.9	8.4	0	6.8	0	5.8	0
263	2.2	6.9	11.8	0	6.4	0	3.9	0
264	0	9.3	2.8	4.7	13.9	0	5.1	0
265	10.6	1.7	4.8	3.3	16.0	0	5.6	0
266	3.2	2.9	3.0	2.7	6.7	1.6	3.5	0
267	2.9	7.3	10.9	0	9.6	0	3.0	0
268	1.5	5.2	4.2	5.5	7.1	0	4.0	0
269	3.6	2.7	7.1	4.7	9.7	3.4	3.4	0
269	3.1	1.2	5.4	0	4.9	0	3.4	0
270	1.3	3.4	7.1	0	6.7	0	4.0	0
271	1.3	4.2	5.5	1.9	7.2	0	3.6	0
272	4.0	1.0	2.4	2.9	11.8	0	3.5	0
273	1.5	3.3	4.5	1.9	5.0	0	3.5	0
274	0.9	3.9	7.6	3.2	6.3	0	3.7	0
275	1.7	3.8	3.0	2.8	6.4	0	4.7	0
276	2.2	2.8	5.7	1.8	5.9	0	4.2	0
277	2.0	1.0	3.9	4.1	8.3	0	6.3	0
278	2.5	2.8	5.0	0	5.6	0	4.9	0
279	2.6	2.0	5.4	3.8	6.9	0	3.9	0
280	2.7	2.3	7.5	0	6.4	0	3.9	0
281	4.7	0	5.5	1.7	4.7	1.6	3.7	0
282	1.3	3.7	2.5	3.7	5.2	0	3.2	0
283	1.9	4.7	6.7	0	5.0	0	4.5	0
284	2.3	6.4	2.7	3.9	6.1	0	3.3	0
285	6.0	2.2	5.3	0	6.3	1.5	5.3	0
286	2.3	6.3	5.3	1.5	7.3	0	4.6	0

287	4.3	4.7	5.7	0	5.5	0	3.0	1.7
288	2.3	4.2	2.9	3.7	7.0	0	4.0	1.5
289	2.0	4.6	2.3	3.4	5.9	0	6.2	0
290	2.2	5.6	2.5	5.4	7.2	0	4.3	0
291	1.3	8.3	3.3	2.9	3.2	2.3	9.1	0
292	2.1	5.0	4.2	1.9	5.8	0	4.8	0
293	2.1	4.0	5.7	1.6	4.7	0	5.2	0
294	1.2	4.8	3.2	1.8	7.4	0	4.4	0
295	1.2	9.9	3.5	4.0	4.9	1.6	5.9	0
296	1.3	3.8	4.2	1.4	6.5	0	4.9	0
297	1.7	5.1	2.5	4.2	8.4	0	5.4	0
298	4.1	2.3	3.8	3.4	6.3	0	4.3	0
299	0	6.0	5.7	0	8.2	0	4.7	0
300	2.3	3.9	3.1	2.1	6.6	1.8	3.7	3.7
301	1.4	1.3	2.0	2.8	4.9	0	1.1	0
302	1.7	3.5	1.0	3.7	5.6	1.6	4.2	0
313	0.9	4.0	3.6	1.3	4.0	0	3.9	0
314	3.0	2.5	2.4	2.9	4.9	0	4.1	0
315	15.7	3.1	2.7	3.4	3.6	3.0	4.1	0
316	7.1	2.5	4.8	5.5	10.6	0	4.1	0
317	9.8	0	4.8	0	8.3	0	6.1	0
318	6.9	2.7	2.6	5.9	7.0	2.1	4.9	0
319	6.4	5.4	3.5	7.2	14.7	0	13.8	0
320	13.5	0	11.2	0	10.2	5.8	8.0	0
321	15.0	0	1.3	7.1	13.6	0	5.7	0
322	5.9	11.5	7.8	2.6	6.2	4.1	5.5	0
323	5.9	11.5	7.8	2.6	4.4	7.9	5.5	0
324	9.7	4.6	8.4	4.9	12.7	0	6.2	0
325	4.6	4.7	10.1	0.7	10.2	0	7.0	0
326	8.0	4.3	6.2	2.3	9.6	0	6.3	0
327	11.6	3.5	6.9	4.0	13.2	0	6.1	0
328	6.6	8.7	7.0	2.4	13.0	0	5.9	0
329	7.2	8.2	9.5	0	9.2	0	5.2	0
330	2.2	7.4	2.2	10.4	8.8	0	5.4	0
331	0	10.4	9.7	1.9	14.8	0	5.8	0
332	7.3	10.0	7.4	6.6	10.8	0	5.3	0
333	4.3	6.1	5.5	1.5	6.4	3.9	3.8	0
334	2.0	7.9	3.3	7.1	8.8	2.4	5.1	0
335	7.1	7.8	4.5	5.9	16.3	0	4.9	0
336	2.8	12.4	7.4	2.9	9.3	0	4.9	0
337	4.2	6.9	5.3	4.2	14.3	0	4.1	0
338	5.7	1.7	4.4	11.4	14.5	0	6.0	0
339	8.5	2.8	6.5	4.5	5.7	6.1	6.9	0
340	4.0	12.3	3.3	5.1	9.3	0	3.6	0
341	9.1	1.9	8.0	3.3	7.7	2.9	4.7	0
342	3.4	9.8	7.2	3.4	12.7	0	8.3	0
343	5.2	6.3	4.0	6.9	12.4	0	5.2	0
344	11.3	5.4	3.8	5.9	2.2	11.4	7.1	0
345	4.8	5.3	1.9	8.0	11.8	0	6.2	0
346	2.9	4.0	3.0	5.1	3.4	9.6	3.9	0
347	5.8	4.2	6.6	6.2	12.3	0	5.7	0

348	2.5	8.5	11.7	0	13.1	0	6.2	0
349	12.7	4.9	14.0	4.1	10.0	0	5.6	0
350	2.4	17.4	8.5	6.4	6.5	6.4	3.8	3.0

APPENDIX G
DATA FOR SUBJECT LT

Laboratory and non-laboratory data for subject LT. Laboratory data are calculated in mean responses/minute/session with total session duration as the denominator in Phase 1 and cumulative latency from sample to comparison responses in Phase 2. Non-laboratory data are presented with total latencies for correct and incorrect responses across all four stimuli separated with respect to each procedure (Look-Say, Listen-Find, Look-Find, and Listen-Say).

APPENDIX G

DATA FOR SUBJECT LT

Laboratory

Session	Comparisons (1) C	IC	(2) C	IC
Phase 1.				
1	2.4	18.0	6.0	30.0
2	1.8	24.0	12.0	24.0
3	3.0	18.0	114.0	6.0
4	2.4	18.0	12.0	18.0
5	12.0	30.0	12.0	24.0
6	12.0	12.0	3.0	24.0
7	18.0	18.0	2.4	24.0
8	6.0	6.0	6.0	36.8
9	18.0	4.8	4.8	18.0
10	18.0	12.0	6.0	24.0
11	18.0	18.0	12.0	24.0
12	6.0	12.0	18.0	6.0
13	18.0	12.0	18.0	18.0
14	24.0	12.0	00.0	30.0
15	18.0	12.0	00.0	30.0
16	24.0	12.0	00.0	30.0
17	36.0	6.0	4.2	6.0
18	24.0	6.0	4.2	12.0
19	24.0	6.0	6.0	6.0
20	24.0	6.0	00.0	18.0
21	30.0	1.8	00.0	18.0
22	18.0	12.0	18.0	18.0
23	30.0	6.0	18.0	18.0
24	24.0	00.0	12.0	18.0
25	24.0	00.0	6.0	24.0
26	30.0	6.0	00.0	00.0
27	24.0	12.0	12.0	30.0
28	12.0	12.0	24.0	12.0
29	30.0	6.0	18.0	18.0
30	18.0	6.0	18.0	18.0

31	12.0	2.0	6.0	24.0
32	18.0	6.0	18.0	18.0
33	18.0	12.0	12.0	12.0
34	12.0	4.8	6.0	30.0
35	24.0	4.8	6.0	24.0
36	6.0	6.0	12.0	18.0
37	30.0	18.0	12.0	18.0
38	36.0	12.0	12.0	18.0
39	3.6	00.0	12.0	24.0
40	30.0	42.0	48.0	126.0
41	36.0	3.6	4.2	18.0
42	30.0	3.0	4.2	00.0
43	12.0	6.0	12.0	18.0
44	30.0	3.6	12.0	24.0
45	24.0	2.4	24.0	12.0
46	24.0	2.4	18.0	12.0
47	30.0	00.0	18.0	18.0
48	24.0	3.0	24.0	5.4
49	30.0	00.0	30.0	00.0
50	4.8	00.0	00.0	00.0
51	24.0	00.0	00.0	00.0
52	30.0	00.0	00.0	30.0
53	30.0	00.0	2.4	18.0
54	30.0	00.0	2.4	18.0
55	30.0	00.0	12.0	30.0
56	18.0	00.0	6.0	30.0
57	30.0	00.0	4.8	24.0
58	30.0	00.0	4.2	30.0
59	36.0	00.0	00.0	42.0
60	18.0	18.0	00.0	00.0
61	24.0	00.0	00.0	00.0
62	24.0	3.6	00.0	00.0
63	174.0	00.0	00.0	00.0
64	30.0	00.0	48.0	3.6
65	4.8	12.0	3.6	24.0
66	24.0	00.0	5.4	24.0
67	24.0	00.0	6.0	18.0
68	180.0	36.0	30.0	1.8
69	78.0	00.0	00.0	24.0
70	24.0	3.6	18.0	6.0
71	24.0	00.0	12.0	18.0
72	36.0	00.0	12.0	18.0
73	12.0	2.4	3.6	24.0
74	30.0	00.0	4.8	24.0
75	36.0	00.0	2.4	2.4
76	24.0	00.0	12.0	6.0
77	36.0	00.0	6.0	12.0
78	00.0	6.6	18.0	6.0
79	12.0	12.0	12.0	12.0
80	00.0	00.0	12.0	12.0
81	00.0	00.0	3.6	18.0

82	36.0	00.0	12.0	12.0
83	48.0	00.0	6.0	18.0
84	36.0	00.0	24.0	12.0
85	24.0	12.0	36.0	1.2
86	36.0	4.8	24.0	00.0
87	30.0	00.0	6.0	18.0
88	30.0	00.0	24.0	0.6
89	30.0	00.0	12.0	18.0
90	36.0	00.0	18.0	6.0
91	24.0	00.0	18.0	12.0
92	36.0	00.0	36.0	00.0
93	30.0	00.0	3.0	30.0
94	24.0	3.6	5.4	18.0
95	18.0	00.0	00.0	24.0
96	18.0	00.0	36.0	00.0
97	24.0	00.0	12.0	18.0
98	6.0	00.0	12.0	6.0
99	24.0	00.0	24.0	12.0
100	36.0	1.2	18.0	12.0
101	36.0	00.0	18.0	12.0
102	36.0	1.2	18.0	12.0
103	36.0	1.2	18.0	12.0
104	36.0	00.0	6.0	24.0
105	24.0	00.0	6.0	30.0
106	30.0	00.0	5.4	36.0
107	30.0	00.0	12.0	18.0
108	36.0	00.0	6.0	12.0
109	36.0	00.0	6.0	18.0
110	48.0	00.0	12.0	12.0
111	42.0	00.0	12.0	6.0
112	18.0	00.0	18.0	6.0
113	42.0	00.0	12.0	12.0
114	30.0	00.0	18.0	00.0
115	12.0	2.4	18.0	4.8
116	30.0	00.0	24.0	00.0
117	30.0	00.0	12.0	6.0
118	42.0	00.0	12.0	6.0
119	42.0	00.0	18.0	6.0
120	42.0	00.0	18.0	1.8
121	42.0	00.0	18.0	12.0
122	42.0	00.0	36.0	24.0
123	42.0	00.0	12.0	12.0
124	36.0	00.0	12.0	6.0
125	42.0	00.0	12.0	6.0
126	36.0	00.0	2.4	6.0
127	30.0	00.0	18.0	12.0
128	42.0	00.0	18.0	6.0
129	42.0	00.0	18.0	6.0
130	42.0	00.0	24.0	3.6
131	36.0	4.2	24.0	4.8
132	24.0	00.0	24.0	1.8

133	24.0	00.0	5.4	24.0
134	36.0	4.2	6.0	24.0
135	36.0	00.0	6.0	24.0
136	42.0	00.0	12.0	18.0
137	36.0	00.0	5.4	24.0
138	36.0	00.0	6.0	12.0
139	42.0	00.0	6.0	24.0
140	36.0	00.0	12.0	18.0
141	36.0	00.0	18.0	12.0
142	30.0	00.0	----	----
143	24.0	00.0	----	----
144	18.0	00.0	----	----
145	36.0	00.0	----	----
146	36.0	00.0	----	----
147	42.0	00.0	----	----
148	36.0	00.0	----	----
149	42.0	00.0	----	----
150	36.0	00.0	----	----
151	42.0	00.0	----	----
152	42.0	00.0	----	----
153	48.0	00.0	----	----
154	30.0	00.0	----	----
155	42.0	00.0	----	----
156	42.0	00.0	----	----
157	42.0	00.0	----	----
158	18.0	3.0	----	----
159	42.0	00.0	----	----

Pre-laboratory

	Look-Say		Listen-Find		Look-Find		Listen-Say	
Session #	C	IC	C	IC	C	IC	C	IC
1	0	30.9	7.5	1.0	3.9	6.7	4.1	0
2	6.5	3.3	4.8	1.8	6.1	0	4.6	0
3	1.0	14.7	4.1	9.1	4.8	8.0	7.3	0
4	1.5	18.3	4.8	5.5	8.0	3.1	7.5	0
5	1.5	17.8	6.9	6.2	10.0	4.4	12.5	0
6	4.8	1.3	12.2	6.2	6.8	3.2	9.4	0
7	5.6	23.0	8.9	3.1	2.6	1.0	7.7	0
8	0.7	5.1	1.3	9.3	0.9	10.6	3.6	0
9	1.7	14.2	5.4	6.5	5.7	8.0	6.3	0
10	5.7	20.0	5.7	8.9	6.2	0	8.9	0
11	0	8.2	2.5	5.8	5.1	0	5.1	0
12	1.6	7.0	1.6	5.3	3.6	3.1	2.3	0
13	1.0	9.8	0	7.9	8.9	2.4	6.0	0
14	0	17.4	3.1	2.0	0	9.4	3.4	0
15	1.0	4.8	3.3	8.8	3.1	6.2	3.3	0
16	1.2	6.6	0.9	11.5	0	13.7	4.0	0

17	6.5	18.4	5.0	7.6	9.1	0	6.9	0
18	2.7	1.8	3.9	2.2	6.0	3.9	4.7	0
19	3.8	8.5	6.9	10.0	5.3	5.1	10.5	0
20	2.5	6.5	9.4	9.3	6.6	2.0	9.8	0
21	1.1	3.6	0.8	4.8	7.5	3.2	5.6	0
22	1.6	4.0	4.0	7.8	6.1	8.0	5.7	0
23	1.5	12.5	5.0	6.1	5.9	9.1	4.7	0
24	1.6	6.1	6.6	1.6	6.7	4.7	7.4	0
25	1.7	6.7	9.0	12.8	10.9	8.9	5.9	0
26	2.9	9.5	3.2	9.3	1.4	6.2	10.9	0
27	4.5	7.2	3.6	15.0	6.4	10.0	16.4	0
28	7.5	4.7	1.2	11.9	2.5	11.2	5.4	0
29	1.6	3.3	1.1	11.5	4.7	0	6.0	0
30	3.3	3.5	4.7	1.3	3.2	4.2	5.4	0
31	2.2	4.1	7.2	13.6	6.1	6.9	6.9	0
32	2.0	4.9	4.8	6.5	2.7	4.9	3.6	0
33	1.4	4.8	8.0	8.9	7.4	2.3	9.0	0
34	1.9	5.2	5.4	0	2.7	3.8	9.6	0
35	0	6.4	6.2	4.0	3.4	2.6	6.4	0
36	3.0	13.0	9.8	3.7	3.1	5.5	8.4	0
37	3.3	3.5	6.2	7.0	4.7	6.8	4.6	0
38	2.4	3.1	1.9	8.5	6.8	5.2	9.4	0
39	3.2	4.2	7.2	2.1	8.1	0	4.4	0
40	1.1	10.3	9.5	2.0	19.4	0	7.2	0
41	12.0	2.0	10.1	2.3	8.4	2.6	8.3	0
42	1.6	4.2	8.0	5.6	11.3	0	3.9	0
43	6.6	4.6	9.7	0	9.5	0	9.9	0
44	5.1	7.8	5.0	0	6.2	0	8.4	0
45	2.2	3.1	13.5	10.0	7.5	0	12.1	0
46	6.4	0	11.5	0	9.8	0	13.1	0
47	4.2	1.6	9.5	0	13.0	0	10.1	0
48	2.5	2.9	7.2	0	6.6	0	9.5	0
50	0	8.2	10.0	0	7.6	0	12.5	0
51	1.6	12.4	4.6	16.7	13.4	10.1	14.6	0
52	2.5	5.3	4.4	4.2	4.7	0	14.1	0
53	3.1	3.1	6.8	0	8.5	0	7.0	0
54	3.0	3.8	6.9	0	4.7	0	7.4	0
55	4.7	7.6	7.3	2.3	5.4	0	11.1	0
56	2.8	8.0	2.5	3.6	7.0	0	5.9	0
57	1.8	4.2	5.4	0	6.5	0	6.8	0
58	4.1	6.6	11.3	3.6	4.8	3.0	7.2	0
59	4.2	8.2	3.8	3.1	6.7	0	6.0	0
60	1.7	9.5	5.1	0	13.3	0	3.4	0
61	5.6	1.1	4.1	2.4	6.4	3.5	4.2	0
62	2.2	7.2	4.2	1.5	8.3	0	6.8	0
63	1.1	10.2	3.3	1.2	4.1	5.4	6.6	0
64	4.7	4.3	12.7	0	4.9	2.3	11.1	0
65	1.0	5.6	5.9	1.5	3.4	3.9	5.8	0
66	4.1	1.2	3.5	3.3	3.9	3.9	4.6	0
67	1.1	8.3	4.2	3.0	5.2	2.0	4.4	0
68	2.7	3.8	5.0	2.1	10.1	0	3.5	0

69	2.0	2.6	2.3	4.2	18.0	0	7.0	0
70	2.9	4.1	5.9	2.3	10.5	0	3.1	0
71	10.9	0	5.5	1.8	4.2	4.6	3.7	0
72	11.1	0	6.0	1.5	4.8	5.2	4.1	0
73	2.8	4.0	4.1	1.4	3.9	2.8	5.2	0
74	3.3	1.6	3.3	0	5.5	0	8.9	0
75	3.1	0.9	3.7	1.9	15.5	0	7.1	0
76	7.7	1.7	3.0	3.8	4.1	2.3	4.9	0
77	2.6	3.9	3.8	4.7	10.1	0	4.8	0
78	2.3	3.8	2.4	7.0	4.5	0	3.8	0
79	2.1	8.2	6.3	3.0	7.5	0	4.7	0
80	2.4	3.3	3.7	1.7	5.5	4.3	5.0	0
81	1.6	5.8	2.4	3.4	5.2	2.7	6.3	0
82	4.0	1.6	4.1	1.4	4.4	0	9.2	0
83	6.3	6.7	6.1	1.4	10.7	0	9.0	0
84	4.7	1.5	4.2	1.7	6.6	0	4.7	0
85	1.3	7.4	3.2	1.7	4.3	2.7	6.0	0
86	1.3	5.3	7.1	0	7.0	0	7.7	0
87	0	7.7	6.8	0	9.0	0	9.8	0
88	2.5	3.4	3.4	1.0	6.2	0	5.4	0
89	2.2	2.6	4.1	3.6	5.4	0	6.1	0
90	1.1	5.6	3.5	1.0	5.0	0	9.4	0
91	3.0	2.2	3.0	0	4.7	0	4.8	0
92	8.6	2.2	4.9	0	3.8	0	6.6	0
93	1.1	8.3	3.0	1.9	5.3	0	3.9	0
94	1.7	9.5	3.2	0	5.5	0	11.3	0
95	5.9	1.0	5.3	0	4.9	0	6.6	0
96	4.2	0.9	2.2	2.5	4.6	0	3.8	0
97	6.0	4.2	3.4	2.0	5.7	0	6.5	0
98	6.5	3.7	3.4	1.2	4.9	0	5.1	0
99	2.3	3.2	3.0	1.8	3.8	2.6	3.9	0
100	2.8	1.2	3.4	1.6	5.3	0	6.0	0
101	2.6	2.9	4.2	2.2	7.6	0	5.6	0
102	1.1	3.7	3.3	2.4	4.7	0	3.6	0
103	4.0	2.5	2.6	1.1	4.6	0	5.4	0
104	2.5	3.0	2.0	5.5	2.9	1.7	3.9	0
105	3.9	0.9	2.8	1.5	7.6	0	3.4	0
106	4.8	1.0	3.5	0	6.1	0	4.1	0
107	3.9	1.0	4.2	1.1	6.0	0	5.3	0
108	1.8	2.5	3.1	1.9	9.3	1.7	5.3	0
109	0.9	6.1	3.3	3.0	7.3	0	3.1	0
110	1.4	2.5	2.9	5.4	5.1	0	3.1	7.0
111	2.7	5.8	5.5	4.2	7.3	0	3.6	0
112	5.5	4.8	2.9	2.1	7.6	1.1	5.6	0

During-laboratory

113	8.5	0	3.8	3.8	15.5	6.0	7.7	0
114	4.5	1.4	1.8	3.3	5.6	4.5	7.5	0
115	5.2	1.9	3.8	1.4	13.8	0	8.4	0
116	4.4	7.3	5.5	0	4.6	4.1	4.5	0

117	2.9	3.0	4.2	1.8	4.0	1.7	3.8	0
118	12.4	1.4	4.4	2.3	7.1	2.4	4.0	0
119	3.7	6.2	6.0	0	5.8	0	7.3	0
120	24.4	0	5.5	0	6.4	0	8.5	0
121	5.7	1.3	3.2	2.9	5.2	0	5.5	0
122	1.4	2.7	4.7	1.4	4.9	0	8.6	0
123	12.1	6.0	3.7	0	7.0	0	6.0	0
124	2.9	2.5	4.3	3.7	5.0	0	6.5	0
125	1.7	1.9	2.8	4.3	3.3	3.4	3.9	0
126	0	4.6	3.3	1.3	5.3	0	2.2	0
127	1.0	3.0	5.1	0	6.1	0	4.0	0
128	0	4.0	2.8	1.5	4.4	0	4.0	0
129	1.0	4.3	2.1	4.3	5.7	0	2.8	0
130	1.5	3.4	3.4	1.6	4.3	0	7.5	0
131	2.0	1.9	4.6	0	9.4	0	3.7	0
132	0	4.8	4.9	1.7	5.1	0	2.9	0
133	3.2	2.8	2.9	2.7	4.2	0	2.7	0
134	2.3	4.9	4.1	1.4	5.2	0	2.3	0
135	0.9	3.8	7.2	2.9	4.6	3.4	6.6	0
136	3.1	0.9	3.9	1.4	12.5	0	4.6	0
137	2.2	2.4	5.3	1.4	8.7	0	5.0	0
138	3.4	1.0	6.7	0	8.8	1.6	2.1	0
139	2.1	2.0	5.3	0	6.2	0	4.6	0
140	2.5	1.1	5.9	0	5.6	0	2.7	0
141	3.6	0	3.9	0	6.0	0	2.3	0
142	5.0	2.0	3.8	2.3	7.5	0	2.6	0
143	3.7	0.8	5.7	0	6.6	0	3.5	0
144	6.6	6.3	5.7	0	9.0	0	3.8	0
145	2.0	4.5	3.9	2.1	5.5	0	3.1	0
146	3.5	6.7	10.4	0	11.4	0	2.5	0
147	2.7	2.8	4.5	0	7.7	0	2.9	0
149	1.8	4.8	3.3	2.5	6.2	0	2.2	0
150	7.2	0	2.8	3.7	7.9	0	2.3	0
151	4.8	4.8	5.6	0	11.6	0	3.0	0
152	5.3	0	5.9	0	7.2	0	5.6	0
153	4.8	0	4.1	0	8.3	0	3.9	0
154	5.8	1.8	3.8	0	4.0	1.7	3.4	0
155	13.3	7.9	2.9	2.6	3.7	2.1	5.3	0
156	4.7	1.7	4.1	0	3.8	2.8	4.0	0
157	3.9	4.7	4.8	0	10.8	0	5.2	0
158	4.1	1.1	5.9	0	6.9	0	3.2	0
159	4.6	5.5	4.8	0	7.5	7.8	3.7	0
160	1.4	5.9	2.1	3.6	3.4	3.4	5.9	0
161	5.7	1.4	3.6	1.4	6.0	2.4	3.5	0
162	4.4	1.9	7.3	0	4.5	1.3	4.5	0
163	4.4	1.6	2.1	2.3	8.2	0	5.6	0
164	3.2	7.0	4.3	1.7	4.1	5.7	2.7	2.9
165	6.5	3.3	6.3	1.5	8.3	0	2.3	5.8
166	4.4	10.7	4.3	1.7	4.4	10.0	3.8	10.0
167	3.2	3.9	2.2	2.4	4.0	4.9	4.8	0
168	4.4	2.7	6.8	0	13.6	0	4.4	0

169	4.8	1.5	5.6	2.1	11.4	0	4.0	0
170	5.0	0	3.1	1.0	6.3	0	5.1	0
171	3.2	1.6	3.1	1.0	4.5	2.8	3.3	0
172	2.1	4.4	6.2	0	7.0	0	4.6	0
173	2.5	4.6	4.8	0	3.9	1.7	4.3	0
174	0	4.9	3.1	1.2	10.7	0	3.8	0
175	1.6	6.8	5.2	0	4.8	3.3	4.7	0
176	3.1	1.6	3.6	0.9	4.9	2.5	4.1	0
177	4.5	1.3	6.5	0	3.6	1.6	4.9	0
178	2.8	3.4	3.0	1.1	5.7	0	5.2	0
179	4.0	0.9	3.7	0	5.6	0	3.3	0
180	2.5	2.4	5.8	0	4.9	0	4.0	0
181	3.3	2.2	5.8	0	4.2	2.9	4.3	0
182	2.9	2.7	3.1	1.2	4.7	0	3.6	0
183	2.5	3.0	5.0	0	2.8	3.3	3.5	0
184	1.0	3.8	7.7	0.9	3.2	1.2	5.2	0
185	1.3	3.7	3.2	2.6	3.8	9.6	5.7	0
186	2.4	3.6	4.2	0	5.5	0	6.2	0
187	1.3	4.0	6.1	0	5.5	0	2.7	0
188	0	7.6	1.7	3.2	4.2	0	4.0	0
189	1.1	3.9	3.2	3.0	4.4	0	4.1	0
190	0	12.6	1.4	8.9	5.7	0	4.0	0
191	1.8	5.3	4.8	1.5	4.9	0	4.0	0
192	0.8	5.5	3.3	2.2	4.2	2.4	3.2	0
193	0	4.4	1.3	5.2	2.4	6.1	2.2	8.0
194	0	7.2	4.2	1.1	6.9	0	3.1	0
195	2.8	3.8	7.0	0	5.8	2.4	4.9	0
196	1.2	4.4	2.2	2.2	6.2	0	3.2	0
197	2.2	5.4	4.3	1.2	5.0	0	3.5	0
198	2.1	6.4	5.5	1.2	6.7	0	12.6	0
199	0	9.1	1.2	7.5	1.3	7.4	2.2	6.6
200	0	3.4	1.1	4.9	5.9	0	2.8	9.1
201	0	15.3	3.6	1.6	5.3	0	4.0	0
202	1.1	3.3	7.1	0	2.8	7.3	4.1	0
203	2.2	2.5	6.0	0	4.4	0	7.2	0
204	2.9	1.3	4.9	0	5.3	0	2.6	0
205	0.6	3.6	5.1	0	3.6	0	2.9	0
206	4.7	0	4.7	0	4.9	0	4.6	0
207	0	5.1	6.2	0	4.0	0	3.7	0
208	1.5	1.6	4.4	0	3.2	0	6.2	0
209	3.1	0.8	3.0	1.3	4.5	0	8.0	0
210	1.0	9.4	4.9	0	6.4	0	3.8	0
211	2.6	3.7	4.0	8.9	1.5	3.2	7.4	0
212	1.0	4.3	3.7	1.5	6.2	0	2.8	0
213	0.7	2.6	6.5	0	6.2	0	5.5	0
214	0.7	1.0	3.6	6.0	3.9	1.2	0.8	0
215	1.1	3.0	2.7	2.4	4.8	1.4	2.6	0
216	1.0	3.1	3.6	1.1	4.3	0	2.2	0
217	0	7.3	7.7	0	4.6	0	3.8	0
218	1.2	14.6	3.5	7.5	2.8	4.4	2.7	0
219	0.9	3.1	1.4	4.0	3.1	2.3	2.6	0

220	2.1	2.0	2.8	2.8	6.2	0	6.3	0
221	0	4.1	4.7	15.0	6.4	0	3.8	0
222	0.9	2.8	4.2	2.4	8.7	0	4.1	0
223	1.0	3.1	4.2	1.5	6.4	0	5.8	0
224	4.2	3.3	5.7	1.6	9.3	0	4.4	0
225	3.0	2.0	5.4	2.2	6.9	0	5.5	0
226	4.6	1.1	6.7	0	5.4	0	4.5	0
227	4.5	2.7	9.0	0	6.5	0	8.6	0
228	3.9	1.3	6.7	0	8.4	0	3.4	0
229	1.6	2.4	5.7	0	6.9	0	3.9	0
230	2.4	1.8	10.2	0	6.4	0	3.8	0
231	2.5	2.1	8.5	0	3.8	0	3.4	0
232	1.7	2.5	5.9	0	6.2	0	2.7	0
233	7.5	0	8.1	0	6.0	0	9.5	0
234	1.4	5.8	4.4	0	5.9	0	2.8	0
235	2.0	11.2	2.9	0	5.5	4.8	2.2	0.5
236	9.4	1.5	8.0	0	5.4	0	3.5	0
237	2.8	1.3	6.1	0	9.8	0	5.9	0
238	2.5	0	3.0	1.9	4.5	0	1.9	0
239	0.6	4.7	5.5	2.0	6.0	0	2.7	0
240	3.0	2.2	7.9	0	6.2	0	2.4	0
241	0.7	2.8	5.8	0	10.1	0	2.9	0
242	1.5	1.9	8.4	0	6.9	0	2.3	0.8
243	3.9	3.2	4.6	0	6.5	0	2.2	1.5
244	2.1	2.9	6.2	0	5.9	0	3.0	0
245	4.3	1.9	5.1	0	5.2	0	2.4	0.8
246	0	9.1	9.0	0	8.6	0	3.6	0.7
247	0.8	2.0	7.2	0	6.3	0	1.2	3.6
248	2.2	2.5	4.4	0	6.2	0	6.3	0
249	1.5	2.0	4.5	0	4.5	0	3.0	0
250	3.4	1.5	7.7	0	5.8	0	4.1	0
251	1.5	1.0	4.8	0	6.0	0	2.7	0
252	5.0	0	4.6	0	5.4	0	3.9	0
253	2.5	1.1	7.1	0	5.6	0	2.8	0
254	2.9	1.3	6.6	0	8.2	0	4.0	0
255	2.8	4.8	4.6	0	4.7	1.5	2.2	0
256	2.1	1.9	3.7	3.0	6.1	0	3.6	0
257	1.0	6.8	4.3	1.8	6.0	0	4.1	0
258	2.5	2.2	1.9	1.5	6.9	0	4.3	0
259	5.8	1.7	6.2	0	9.1	0	4.0	0
260	3.9	7.6	6.6	0	7.3	0	3.7	0
261	3.5	6.2	7.1	0	7.9	0	3.1	0
262	8.5	8.0	6.0	0	5.3	0	4.3	0
263	3.8	0	5.6	0	4.8	0	3.2	0
264	3.5	8.8	4.4	0	6.6	0	3.1	0
265	3.8	3.6	3.5	3.1	6.5	0	3.3	0
266	2.9	6.4	7.1	0	6.4	0	3.3	0
267	1.9	10.6	4.6	0	6.7	0	4.4	0
268	1.9	7.6	5.1	0	13.1	0	3.0	0
269	1.8	8.6	3.0	6.7	6.3	2.1	3.2	0
270	0.6	6.1	3.6	2.2	7.0	0	3.0	0

271	0.6	5.0	2.5	1.0	5.4	0	2.5	0
272	0.6	4.5	3.9	0	4.7	2.8	3.4	0
273	0.7	2.5	4.7	0	6.8	0	3.2	0
274	1.8	3.9	7.1	0	5.8	0	3.1	0

Post-laboratory

275	0.9	2.8	4.2	0	5.7	0	4.7	0
276	2.3	2.8	3.2	3.4	5.9	0	3.6	0
277	0.9	13.9	3.5	2.1	5.4	4.9	2.5	0
278	1.5	4.3	4.5	0	7.5	0	2.9	0
279	0.5	17.6	5.7	0	5.2	0	2.7	0
280	6.9	2.6	3.7	0	6.0	0	2.8	0
281	3.5	2.5	3.0	0	4.2	0	4.8	0
282	2.2	4.4	3.9	0	5.2	0	2.8	0
283	2.6	1.4	4.2	0	7.6	0	3.1	0
284	6.7	0	3.9	0	4.6	0	3.0	0
285	4.0	7.9	7.0	0	4.9	0	3.3	0
286	1.5	3.0	5.4	0	3.8	0	2.9	0
287	3.1	0	4.3	0	2.6	1.7	1.8	0
288	5.1	0	3.4	1.6	6.6	0	3.0	0
289	4.8	0	4.5	0	5.5	0	2.5	0
290	2.7	1.0	4.6	0	5.4	0	1.8	0
291	6.0	1.3	6.0	0	10.0	0	2.8	0
292	4.2	3.5	4.3	1.2	5.9	0	5.8	0
293	2.3	2.6	6.7	0	7.1	0	2.9	0
294	1.7	4.4	4.6	0	6.5	0	4.3	0
295	6.2	0	6.2	0	5.2	0	3.2	0
296	4.7	2.8	4.6	7.8	8.1	0	8.6	0
297	7.2	0	8.2	0	4.2	1.9	3.0	0
298	1.0	4.8	3.7	0	6.1	0	2.5	0
299	6.3	1.2	4.8	0	6.3	0	2.8	0
300	4.5	5.0	3.2	2.8	5.2	0	4.0	0
301	4.1	8.2	5.5	1.2	8.4	0	3.1	0
302	4.7	0	4.4	0	5.5	0	3.7	0
303	6.2	0	6.2	1.6	5.7	0	8.7	0
304	1.8	4.2	3.8	1.9	6.1	0	4.4	0
305	3.2	1.5	1.0	4.4	5.5	2.2	4.1	0
306	9.7	0	2.1	5.4	6.1	1.7	9.7	0

APPENDIX H
DATA FOR SUBJECT KM

Laboratory and non-laboratory data for subject KM. Laboratory data are calculated in mean responses/minute/session with total session duration as the denominator in Phase 1 and cumulative latency from sample to comparison responses in Phase 2. Non-laboratory data are presented with total latencies for correct and incorrect responses across all four stimuli separated with respect to each procedure (Look-Say, Listen-Find, Look-Find, and Listen-Say).

APPENDIX H

DATA FOR SUBJECT KM

Laboratory

	Comparisons (1) C	(1) IC	(2) C	(2) IC
Session				
Phase 1.				
1	30.0	1.2	----	----
2	3.0	2.4	----	----
3	3.6	1.2	----	----
4	4.2	1.8	----	----
5	3.0	1.8	----	----
6	3.6	1.8	----	----
7	4.2	3.0	----	----
8	1.8	2.4	----	----
9	3.0	1.2	----	----
10	1.8	.2	----	----
11	3.0	1.8	----	----
12	1.8	6.0	----	----
13	1.8	.6	----	----
14	3.0	1.2	----	----
15	3.0	.2	----	----
16	4.2	.1	----	----
17	4.2	.5	----	----
Phase 2.				
1	6.0	24.0	----	----
2	6.0	12.0	----	----
3	6.0	6.0	----	----
4	42.0	12.0	----	----
5	12.0	6.0	----	----
6	6.0	3.0	----	----
7	18.0	12.0	----	----
8	18.0	12.0	----	----
9	30.0	12.0	----	----
10	36.0	6.0	----	----

11	36.0	00.0	6.0	12.0
12	36.0	00.0	18.0	12.0
13	2.4	3.0	12.0	12.0
14	24.0	.3	18.0	6.0
15	6.0	00.0	18.0	12.0
16	48.0	18.0	18.0	12.0
17	12.0	.4	18.0	12.0
18	18.0	00.0	18.0	6.0
19	24.0	.4	6.0	6.0
20	162.0	00.0	18.0	12.0
21	18.0	00.0	18.0	6.0
22	36.0	00.0	12.0	12.0
23	12.0	4.8	12.0	5.4
24	24.0	00.0	12.0	6.0
25	36.0	00.0	6.0	4.2
26	18.0	00.0	12.0	4.8
27	18.0	00.0	12.0	12.0
28	30.0	00.0	18.0	12.0
29	24.0	00.0	18.0	18.0
30	2.4	00.0	12.0	3.6
31	18.0	2.4	12.0	4.8
32	6.0	00.0	6.0	6.0
33	6.0	1.2	6.0	.4
34	18.0	00.0	12.0	1.8
35	24.0	00.0	24.0	1.8
36	24.0	00.0	12.0	1.8
37	30.0	00.0	18.0	1.2
38	24.0	00.0	24.0	3.0
39	42.0	00.0	24.0	6.0
40	24.0	00.0	36.0	3.6
41	48.0	00.0	24.0	18.0
42	18.0	3.6	30.0	1.8
43	24.0	00.0	18.0	6.0
44	48.0	00.0	18.0	6.0
45	30.0	00.0	24.0	3.0
46	36.0	00.0	30.0	00.0
47	18.0	2.4	30.0	00.0
48	24.0	00.0	12.0	00.0
49	24.0	00.0	18.0	1.8
50	18.0	3.6	24.0	3.6
51	18.0	00.0	24.0	2.4
52	24.0	00.0	18.0	00.0
53	24.0	00.0	24.0	3.6
54	18.0	3.6	24.0	2.4
55	12.0	3.0	24.0	00.0
56	12.0	3.0	24.0	2.4
57	12.0	00.0	18.0	5.4
58	24.0	00.0	18.0	00.0
59	24.0	00.0	12.0	.6
60	12.0	1.8	24.0	4.8
61	18.0	00.0	18.0	4.2

62	30.0	00.0	12.0	1.8
63	24.0	4.8	24.0	1.2
64	----	----	30.0	2.4

Pre-laboratory

	Look-Say		Listen-Find		Look-Find		Listen-Say	
Session #	C	IC	C	IC	C	IC	C	IC
1	15.0	0	3.3	22.3	16.2	16.3	10.0	0
2	14.7	0	8.5	20.7	7.1	17.9	20.9	0
3	3.5	12.5	2.1	13.7	17.1	17.2	6.4	0
4	3.0	10.5	7.6	5.7	17.1	6.9	4.9	8.1
5	3.8	8.6	2.9	17.8	12.2	14.4	4.9	10.0
6	3.4	10.6	2.9	21.4	8.4	18.1	3.5	0.6
7	3.8	18.4	2.2	14.7	4.7	27.0	10.0	10.0
8	0	17.9	4.9	9.2	8.3	24.5	6.1	3.4
9	0	17.6	11.9	6.4	13.8	12.0	8.6	0
10	3.2	15.9	5.9	4.0	10.2	6.6	6.9	0
11	2.6	8.7	8.7	7.6	19.3	0	6.0	0
12	0	14.8	14.1	4.1	12.6	19.5	8.3	0
13	2.2	8.1	11.7	7.9	14.5	10.1	6.0	0
14	3.2	14.2	0	12.9	6.6	12.4	8.7	0
15	0	13.2	4.1	4.9	12.6	5.3	9.3	0
16	0	19.5	9.6	12.6	10.7	9.4	7.5	0
17	0	11.7	7.8	6.3	4.1	13.1	5.9	10.0
18	5.1	16.5	7.4	8.2	16.7	7.4	8.3	0
19	1.4	8.3	14.0	6.7	0	25.2	9.0	0
20	0	16.1	13.4	0	11.8	5.4	6.4	3.9
21	0	8.0	4.7	10.7	5.1	14.8	6.4	0
22	2.6	8.0	6.2	2.7	9.9	14.9	8.9	0
23	5.7	12.3	4.7	4.2	9.8	13.2	8.1	0
24	4.0	10.5	6.5	0	7.7	28.3	5.5	0
25	2.4	9.5	13.4	9.9	17.1	6.0	7.5	0
26	2.9	9.5	6.7	6.2	22.8	44.1	6.8	0
27	3.5	18.7	12.0	0	11.7	6.2	6.1	2.5
28	7.1	14.3	8.7	0	10.0	13.1	7.0	0
29	6.5	8.6	8.9	5.6	23.8	0	8.2	0
30	1.1	14.3	0	13.2	18.2	10.0	8.9	0
31	4.2	8.7	4.0	2.3	8.3	14.3	8.3	0
32	4.3	3.0	6.6	2.1	1.6	13.4	6.7	0
33	2.8	7.3	6.0	1.7	13.4	7.8	5.5	0
34	0	17.4	4.5	2.0	12.7	7.5	7.9	0
35	2.6	13.1	5.2	1.9	7.8	7.6	5.1	0
36	0	12.9	8.7	0	21.3	0	9.2	0
37	5.1	8.0	11.0	0	12.2	13.9	7.7	1.9
38	1.9	19.3	7.2	0	2.2	15.2	6.4	0
39	2.5	14.6	7.2	0	3.5	16.7	7.7	0
40	7.7	23.4	3.5	16.7	6.6	13.2	8.7	3.5

41	4.8	6.6	4.7	2.1	22.5	8.1	5.7	0
42	2.7	24.9	6.5	0	0	23.5	5.4	2.6
43	6.6	5.2	12.1	6.9	14.5	5.2	9.1	0
44	8.5	5.0	6.6	4.0	16.9	0	5.8	0
45	5.9	10.5	13.9	0	20.2	8.4	8.2	0
46	9.9	15.7	14.5	0	19.7	0	15.1	7.1
47	0	14.7	14.6	9.7	8.7	13.8	6.4	0
48	6.1	7.1	5.4	1.6	15.4	0	5.4	0
49	0	15.9	7.2	14.8	4.7	10.7	11.3	0
50	3.2	9.8	8.4	0	9.3	14.3	5.6	0
51	2.2	12.0	9.3	0	13.5	2.9	6.9	0
52	3.3	14.5	6.0	2.2	12.3	12.2	6.8	0
53	3.6	14.3	6.3	3.4	10.9	11.1	7.9	0
54	2.3	13.2	10.8	0	7.4	22.2	7.9	0
55	8.7	16.3	19.0	5.6	10.2	8.0	9.8	0
56	0	24.9	18.1	2.2	4.4	19.4	16.7	0
57	9.6	6.0	11.9	0	7.8	21.0	13.3	0
58	2.6	10.1	17.6	0	0	10.5	7.0	0
59	5.8	5.7	9.2	0	17.6	5.1	7.9	0
60	2.2	12.2	11.5	0	6.6	17.0	7.8	0
61	1.6	12.8	13.7	0	0	17.5	6.6	0
62	0	25.1	9.9	0	7.4	9.9	7.0	0
63	0	21.3	12.7	0	14.7	3.6	7.1	0
64	0	16.6	7.3	3.5	4.4	9.3	5.9	0
65	5.3	12.9	8.9	0	16.5	10.0	5.6	0
66	0	17.5	10/4	0	8.6	14.3	9.4	3.3
67	21.0	29.4	12.9	1.8	22.9	5.4	14.8	0
68	2.8	11.8	9.1	0	0	28.1	6.3	0
69	5.6	11.6	7.5	0	13.0	14.2	5.9	0
70	5.9	7.2	8.3	0	14.8	9.1	5.5	0
71	0	23.8	14.0	0	21.1	0	5.5	0
72	6.2	21.8	10.0	0	20.9	6.0	5.2	0
73	3.6	15.7	10.8	0	21.1	0	5.8	0
74	0	25.2	9.0	0	11.1	9.4	7.2	0
75	0	17.5	12.3	10.0	16.2	9.8	6.5	0
76	0	16.1	7.1	10.0	14.0	14.3	6.1	0
77	2.5	13.4	11.7	0	17.1	4.6	8.1	0
78	0	20.5	8.5	0	4.7	11.1	6.5	2.9
79	3.3	11.0	15.2	0	24.3	0	6.7	0
80	5.6	10.4	9.7	7.6	7.6	10.7	11.2	0
81	0	9.5	7.6	0	8.8	4.5	6.2	0
82	0	7.4	7.9	0	7.2	8.0	6.7	0
83	0	11.6	11.7	0	7.3	24.6	6.8	0
84	3.6	4.3	9.0	3.4	7.8	9.4	5.6	0
85	5.1	2.8	8.8	0	0	22.6	4.8	1.7
86	4.2	7.7	11.7	0	0	23.1	5.7	0
87	3.5	14.5	5.4	3.6	0	29.5	5.1	0
88	3.0	7.2	18.9	0	28.1	11.7	5.7	0
89	7.0	6.0	7.0	0	13.9	8.9	6.6	0
90	2.0	9.7	7.9	0	15.6	0	7.2	0
91	2.1	14.6	7.7	0	9.4	4.7	5.2	2.1

92	0.9	7.5	6.3	0	12.2	11.3	5.6	0
93	0	10.3	7.9	0	37.8	9.4	6.2	0
94	0	12.6	7.0	1.9	13.2	7.6	5.9	2.0
95	10.0	4.6	12.4	0	8.0	14.3	7.1	3.2
96	6.2	6.2	8.6	0	5.6	17.1	5.6	1.7
97	5.9	7.6	9.3	0	7.5	6.1	6.9	6.8
98	9.2	3.2	9.1	0	15.5	5.6	4.9	2.9
99	5.0	6.7	8.4	0	13.5	0	4.2	0
100	8.2	2.6	7.0	0	7.7	6.6	5.3	0
101	6.7	7.6	3.7	5.9	24.9	0	6.7	2.3
102	4.7	6.8	11.1	0	7.5	12.1	3.4	1.8
103	6.2	3.5	7.4	0	15.8	9.2	9.1	0
104	2.0	11.5	15.2	0	10.2	17.3	27.1	0
105	11.1	2.7	9.9	3.4	6.8	12.6	4.9	0
106	3.2	7.8	9.8	0	13.9	7.6	5.2	0
107	3.8	9.9	10.7	0	10.5	3.7	6.4	0
108	2.6	14.1	5.4	10.0	17.5	0	7.6	0
109	11.2	4.0	4.3	0	11.7	3.2	7.6	0
110	10.0	4.8	7.1	0	18.0	0	5.2	0
111	6.6	1.6	5.0	0	14.8	0	5.4	0
112	4.0	6.0	2.3	1.8	11.6	2.7	5.1	0
113	6.4	2.8	10.5	3.2	16.5	7.1	5.6	0
114	5.4	7.3	10.2	0	18.9	5.2	6.2	0
115	5.6	5.0	8.4	0	25.9	10.5	5.9	0
116	0	16.9	12.9	5.6	10.3	8.5	7.3	0
117	3.1	18.3	14.3	2.4	17.8	0	8.2	2.6
118	0	24.9	6.1	22.7	31.5	0	7.1	0
119	2.2	10.6	5.5	0	19.2	14.9	4.5	0
120	5.5	10.5	13.7	0	12.2	5.1	10.9	0
121	1.7	5.1	17.7	0	11.4	0	9.2	0
122	4.6	7.5	6.6	2.3	11.2	0	4.8	0
123	0	14.5	12.1	10.0	1.8	8.7	4.7	0
124	0	32.7	2.2	6.9	28.9	0	16.0	0
125	0	22.8	10.9	0	14.4	8.0	7.0	0
126	2.6	12.7	9.8	6.7	19.9	0	5.7	0
127	0	16.7	3.9	13.6	13.2	0	5.1	1.6
128	6.1	14.8	12.1	0	7.3	11.9	6.4	8.8
129	0	6.9	8.4	0	4.4	11.0	3.5	1.0
130	2.4	10.1	7.1	2.5	11.1	10.3	7.4	0
131	2.7	6.4	4.3	11.3	10.3	13.4	6.7	0
132	2.0	7.7	4.4	3.3	19.7	7.5	3.9	3.0
133	1.5	13.5	11.6	5.2	9.2	12.2	10.3	0
134	10.3	6.5	4.0	4.1	31.4	0	5.8	0
135	0	9.6	6.2	1.8	9.6	10.6	3.0	4.7
136	7.4	4.3	6.0	3.8	13.8	2.8	6.3	0
137	3.7	5.7	3.9	3.4	15.9	5.6	4.5	2.8
138	1.9	9.4	6.8	2.7	9.9	6.7	6.6	0
139	7.5	4.8	7.9	0	12.5	5.0	5.9	1.8
140	5.9	5.0	7.7	0	8.7	5.7	7.4	0
141	4.3	5.8	7.4	0	11.7	0	7.0	0
142	5.0	5.7	5.0	2.1	9.7	3.9	6.8	0

143	5.5	6.4	8.2	0	7.8	8.1	6.6	0
144	6.8	9.9	12.0	0	11.0	4.5	7.8	0
145	4.1	5.5	9.0	0	6.5	7.5	8.2	0
146	5.1	8.5	8.6	6.1	8.6	3.8	5.3	0
147	4.7	15.2	7.6	0	10.9	9.7	4.3	0
148	0	8.1	9.6	1.9	8.0	4.5	6.6	0
149	2.7	6.9	6.0	1.9	6.3	14.0	6.5	0
150	1.7	7.0	8.2	0	0	21.0	5.8	1.6
151	2.3	7.8	9.9	0	8.2	9.2	4.7	0
152	8.0	5.7	9.0	8.1	12.7	2.3	5.3	0
153	3.7	10.3	9.4	5.4	9.0	4.5	5.8	0
154	1.7	16.3	7.6	0	4.6	15.4	6.7	0
155	0	18.0	6.7	0	12.7	0	7.5	0
156	0	9.5	19.7	2.7	8.5	5.4	6.1	0
157	6.7	7.7	10.3	0	11.2	4.0	6.1	0
158	0	19.8	12.6	0	8.1	9.0	6.8	0
159	0	10.3	11.5	0	0	10.5	4.9	0
160	0	7.9	1.5	7.5	9.5	4.2	6.0	0
161	4.0	8.5	12.3	1.3	8.4	10.0	5.6	0
162	2.6	6.9	3.7	9.1	12.9	13.2	3.6	4.1
163	1.5	7.0	6.3	1.6	9.3	5.5	4.9	0
164	0	9.0	6.2	1.9	5.5	10.8	6.1	0
165	0	18.0	13.3	0	0	2.5	6.2	0
166	0	10.3	8.9	0	10.4	1.8	6.2	0
167	0	10.7	10.5	0	12.0	7.2	5.0	0
168	4.3	2.1	5.2	2.7	7.3	9.8	4.7	0
169	6.7	7.8	10.5	0	8.2	9.1	6.0	0
170	4.4	5.1	13.8	0	7.8	7.9	5.2	0
171	4.9	7.6	10.9	0	7.2	8.5	5.6	0
172	25.7	0	10.1	0	19.6	0	6.1	0
173	10.4	0	9.1	0	35.9	0	4.0	0
174	20.8	20.0	15.7	0	17.5	20.0	6.9	0
175	21.5	10.0	19.8	0	25.9	0	5.0	0

<u>During-laboratory</u>

176	2.6	17.0	13.3	2.6	13.7	13.7	7.7	0
177	2.3	8.9	5.2	1.9	13.8	0	9.7	0
178	0	22.1	12.4	0	8.4	13.2	12.0	0
179	4.2	14.9	10.8	0	16.0	0	8.8	0
180	2.3	10.4	8.6	8.5	13.8	0	6.2	0
181	9.6	8.4	14.6	0	18.7	0	10.4	0
182	3.5	12.4	8.8	0	23.3	0	8.1	0
183	0	14.5	13.0	6.8	24.5	0	18.4	0
184	2.8	21.7	48.3	0	17.7	9.5	13.8	10.0
185	3.3	16.5	8.4	0	17.6	11.0	6.8	1.5
186	2.1	8.9	8.8	1.7	21.0	10.1	7.2	0
187	2.1	9.7	7.8	0	14.7	0	6.3	0
188	1.8	9.1	6.2	1.6	21.4	0	8.2	0
189	4.7	7.6	15.5	0	15.8	0	12.8	0
190	6.4	7.3	9.1	0	12.4	0	7.3	0

191	5.9	6.5	6.3	0	8.5	0	6.8	0
192	0	12.5	5.0	3.9	13.3	0	5.8	0
193	0	14.4	5.5	2.1	13.4	0	7.6	0
194	2.4	16.6	10.4	3.9	16.3	0	19.5	0
195	14.4	5.3	8.4	2.6	11.4	0	7.3	2.2
196	4.4	19.0	14.8	0	15.2	0	45.3	0
197	10.6	2.4	5.5	2.5	9.9	0	6.4	0
198	2.3	11.0	24.4	0	49.2	23.0	9.4	0
199	0	12.2	31.7	7.4	40.7	10.0	8.5	4.5
200	5.4	11.5	8.8	0	8.4	3.2	6.2	0
201	4.0	13.0	9.7	0	18.9	0	7.2	10.0
202	12.1	14.2	7.7	5.4	11.6	0	9.9	0
203	5.3	4.8	7.5	0	8.0	2.7	4.8	2.6
204	2.5	5.3	9.6	0	11.8	0	8.1	0
205	4.1	5.3	8.7	0	25.4	0	8.6	0
206	5.9	4.9	8.2	0	9.1	6.1	3.0	4.4
207	2.1	7.8	11.2	3.1	11.9	4.1	11.0	0
208	3.8	3.8	3.5	4.6	7.6	6.3	8.1	0
209	2.5	9.0	5.7	2.5	18.9	0	5.3	0
210	2.9	9.1	9.7	0	11.8	2.3	6.2	0
211	5.4	7.1	9.2	0	11.7	10.8	5.6	9.1
212	3.2	12.9	8.9	16.0	18.7	3.0	6.8	0
213	4.7	4.2	11.3	0	10.7	0	25.5	0
214	4.6	4.2	8.5	0	15.5	0	10.1	0
215	9.9	8.1	10.1	0	7.2	4.2	12.3	0
216	2.4	15.7	5.1	8.5	9.7	10.0	13.1	0
217	3.0	9.3	14.8	0	23.1	5.2	5.7	0
218	3.0	7.2	20.5	0	9.6	0	6.0	0
219	2.5	4.8	18.1	0	14.8	0	5.0	0
220	1.6	5.3	5.7	3.3	14.7	3.3	6.0	0
221	3.7	4.5	10.1	0	13.7	0	8.5	0
222	4.0	3.5	7.5	1.9	8.3	4.1	4.3	0
223	0	7.1	6.1	3.5	6.4	0	5.0	0
224	0	8.6	9.0	0	8.0	0	6.7	0
225	7.1	0	7.7	0	8.6	0	4.4	0
226	2.4	8.2	10.1	0	7.3	0	4.1	0
227	2.5	7.2	8.6	0	6.7	0	4.7	0
228	4.6	7.8	2.7	8.2	1.5	10.2	6.5	0
229	0	9.8	8.8	0	8.5	0	6.7	0
230	3.0	6.4	7.6	0	9.7	0	4.4	0
231	6.8	8.4	6.8	0	13.7	0	18.5	0
232	6.2	9.8	7.1	0	25.2	0	7.4	0
233	4.9	6.0	9.5	0	28.6	0	4.8	0
234	0	8.8	3.3	0	9.4	0	3.4	0
235	8.0	4.3	10.9	0	27.8	0	10.5	0
236	0	11.7	8.5	0	19.5	0	6.6	0
237	2.9	4.8	6.6	2.8	12.7	0	4.5	0
238	4.9	2.8	6.9	0	6.3	0	4.5	0
239	0	14.1	3.1	5.5	7.2	3.6	4.6	0
240	2.6	9.1	6.5	0	8.2	0	4.6	0
241	1.5	8.8	6.7	0	10.5	4.9	4.5	0

242	2.4	10.9	2.7	10.7	0	13.0	7.7	0
243	11.6	3.6	5.5	5.3	5.2	0	6.5	0
244	2.9	13.2	8.5	5.1	9.5	3.8	4.5	0
245	3.4	3.3	11.5	3.8	7.8	4.8	6.6	0
246	10.0	9.6	4.4	5.8	2.8	13.9	4.5	0
247	1.7	10.5	10.1	0	8.3	0	4.2	0
248	1.4	6.4	2.0	8.3	9.4	4.4	5.6	0
249	1.2	7.9	2.1	9.6	9.8	8.7	6.5	2.3
250	0	20.4	5.4	7.6	0	19.1	0	23.4
251	0	10.1	13.2	0	13.3	3.3	8.0	0
252	2.3	a5.0	9.0	3.7	12.7	0	5.2	0
253	2.1	13.2	14.2	0	21.1	0	5.6	0
254	0	22.7	10.6	0	10.9	0	4.0	0
255	11.9	9.8	13.8	0	13.7	0	4.1	0
256	1.2	6.2	7.5	4.7	9.2	10.0	5.6	0
257	2.8	5.6	9.3	2.4	11.0	0	7.8	0
258	8.5	3.1	9.3	0	13.3	0	4.3	0
259	2.9	4.0	9.9	0	9.7	2.5	4.2	0

Post-laboratory

260	0	18.2	14.6	0	14.1	0	7.2	0
261	5.0	4.3	18.6	0	8.8	7.2	4.7	6.9
262	0	13.1	3.8	8.1	9.0	2.1	4.7	1.5
263	1.6	9.3	1.4	15.8	16.8	0	5.7	0
264	7.5	6.1	6.8	2.6	6.5	0	14.1	0
265	2.7	12.0	7.0	3.4	22.1	7.6	5.1	0
266	5.5	12.3	4.7	5.9	10.3	0	7.1	0
267	2.5	14.5	1.8	9.1	15.9	0	7.5	0
268	1.4	9.3	5.3	3.3	18.1	0	6.8	0
269	1.5	9.5	5.2	5.0	10.1	7.2	3.9	0
270	2.2	9.2	8.5	2.2	10.8	4.1	11.4	0
271	3.2	13.1	6.2	7.3	16.2	8.2	7.9	0
272	1.9	14.5	6.8	2.6	11.8	3.6	4.0	0
273	1.1	4.6	4.8	5.6	23.1	0	3.8	0
274	1.1	5.8	10.3	0	10.9	5.1	8.2	0
275	1.9	10.3	6.4	0	7.3	2.8	7.0	0
276	3.6	8.3	4.1	10.2	15.6	0	3.2	1.0
277	1.5	9.6	4.9	7.9	9.4	4.9	8.7	0
278	2.2	7.4	10.0	0	11.0	5.2	5.4	0
279	3.4	9.8	21.4	2.9	11.1	5.3	5.5	0
280	2.4	3.3	4.2	6.0	8.9	2.0	5.3	0
281	8.9	1.8	8.8	10.0	17.3	0	6.8	0
282	0	7.1	7.3	0	13.1	0	3.8	0
283	2.1	5.6	6.2	0	7.1	0	4.3	0
284	3.2	8.4	6.7	0	19.1	0	3.8	0
285	4.4	5.2	8.5	0	7.5	9.7	8.3	0
286	3.6	11.7	8.8	0	7.6	4.9	5.8	0
287	2.1	7.8	6.4	3.4	25.0	0	5.6	0
288	1.1	8.3	5.1	2.3	13.3	4.3	6.4	0
289	1.1	9.5	7.4	0	9.4	4.2	5.4	0

290	8.0	4.2	5.9	3.4	8.2	8.7	3.8	0
291	0	32.2	8.2	21.9	9.6	10.5	5.0	0
292	1.7	12.4	6.3	1.7	7.3	9.1	4.5	0
293	9.7	8.7	4.5	16.3	8.2	4.2	9.7	4.3
294	5.3	11.7	5.6	12.3	11.3	10.6	5.6	0
295	9.3	5.5	4.1	5.1	6.3	10.2	5.4	4.1
296	7.4	9.2	6.8	2.6	7.0	13.0	5.4	0
297	3.8	8.9	5.9	6.8	7.9	12.0	5.9	0
298	0.9	13.8	5.6	2.7	11.7	0	5.0	0
299	5.5	6.5	5.5	4.5	18.2	7.4	7.4	0
300	0	12.1	3.5	3.6	9.9	0	4.8	0
301	5.4	4.3	7.4	0	11.4	3.1	7.6	0
302	5.7	6.7	6.0	2.5	13.9	3.8	4.3	0
303	2.0	7.2	3.3	3.3	8.8	5.5	4.8	0
304	4.9	4.7	11.5	1.6	6.0	7.0	4.8	0
305	0	11.3	5.2	1.1	9.0	6.2	5.4	0
306	6.8	5.3	15.8	0	13.0	0	4.7	0
307	0	16.6	7.5	2.4	4.5	5.7	10.2	0
308	3.7	12.0	9.2	0	14.7	0	7.9	0
309	4.0	8.6	17.0	0	9.0	0	4.7	0
310	0	16.5	5.5	4.3	9.1	0	13.2	0
311	0	24.9	14.7	0	28.9	0	21.1	0
312	0	29.4	8.5	10.0	27.1	0	9.6	4.2
313	18.6	7.1	6.1	1.1	31.7	0	17.1	0
314	6.7	8.8	8.0	10.0	10.4	0	6.6	0
315	0	14.0	4.0	4.0	10.0	0	10.0	0
316	0	13.5	11.0	0	7.9	2.6	5.5	4.2
317	0	10.5	5.0	2.9	23.5	3.4	7.0	1.9
318	5.9	7.9	20.0	3.7	5.9	15.1	20.4	0
319	3.8	29.3	1.8	8.5	8.9	7.2	11.7	0
320	4.6	7.2	6.3	0	14.4	7.6	6.3	0
321	24.4	10.0	7.3	0	17.3	0	6.8	0
322	0	20.4	8.8	0	15.7	0	14.1	0
323	8.3	30.0	9.2	0	11.2	0	13.8	0
324	20.2	12.6	5.5	6.1	11.9	0	7.6	0
325	3.8	24.6	7.5	0	1.0	0	9.1	0
326	43.8	3.8	7.0	4.9	14.4	0	8.2	0
327	13.7	15.6	14.1	9.9	18.1	0	11.2	0
328	9.3	17.1	9.2	0	7.1	0	13.3	0
329	27.4	29.9	10.6	5.9	11.5	6.5	6.1	0
330	5.9	5.4	9.7	0	12.9	0	12.0	0
331	19.3	8.9	5.8	4.6	9.4	20.0	7.4	0
332	2.7	13.9	6.9	0	14.8	0	5.6	0
333	11.8	7.5	9.4	0	14.7	0	7.1	0
334	47.1	0	16.4	0	35.1	0	7.0	0
335	11.4	17.4	14.4	0	12.7	0	11.8	0
336	16.2	5.8	8.9	0	7.9	5.7	7.2	0
337	13.1	0	9.8	0	10.5	0	11.5	0
338	0	36.7	2.8	11.8	7.5	4.2	7.9	0
339	7.2	14.9	16.2	4.2	21.7	0	19.8	0
340	10.5	5.1	29.6	3.9	21.8	0	13.9	0

341	5.6	28.4	6.5	0	27.8	0	17.9	0

REFERENCES

Berthold, H. C., & Sachs, R. H. (1974). Education of the minimally brain damaged child by computer and by teacher. Programmed Learning and Educational Technology, 11, 121-124.

Blackman, L. S., & Capobianco, R. J. (1965). An evaluation of programmed instruction with the mentally retarded utilizing teaching machines. American Journal of Mental Deficiency, 70, 262-269.

Carter, L. F. (1961). Automated instruction. American Psychologist, 16, 705-710.

Catania, A. C. (1973). The nature of learning. In J. A. Nevin (Ed.), The study of behavior. Glenview, Ill.: Scott Foresman.

Catania, A. C. (1975). The myth of self-reinforcement. Behaviorism, 3, 192-199.

Catania, A. C. (1984). Learning. New Jersey: Prentice-Hall.

Cohen, L. R., Looney, T. A., Brady, J. H., & Aucella, A. F. (1976). Differential sample response schedules in the acquisition of conditional discriminations by pigeons. Journal of the Experimental Analysis of Behavior, 26, 301-314.

Engstrom, J., & Whittaker, J. O. (1963). Improving college student's spelling through automated teaching. Psychological Reports, 12, 125-126.

Ferster, C. B., & DeMeyer, M. (1961). The development of performances in autistic children in an automatically controlled environment. Journal of Chronic Disabilities, 13, 312-345.

Ferster C.B., & Skinner, B. F. (1957). Schedules of reinforcement. New York: Appleton-Century-Crofts.

Harlow, H. F. (1949). The formation of learning sets. Psychological Review, 56, 51-65.

Harlow, H. F. (1950). Analysis of discrimination learning by monkeys. Journal of Experimental Psychology, 40, 26-39.

Harlow, H. F. (1959). Learning set and error factor theory. In S. Koch (Ed.), Psychology: A study of a science, Volume 2. New York: McGraw-Hill.

Hively, W. (1964). A multiple-choice visual discrimination apparatus. Journal of the Experimental Analysis of Behavior, 7, 387-389.

Holland, A. L., & Matthews, J. (1963). Application of teaching machine concepts to speech pathology and audiology, ASHA, 5, 474-582.

Holtzman, W. H. (1970). Computer assisted instruction, testing, and guidance. New York: Harper & Row.

Malpass, L. F., Hardy, M. W., Gilmore, A. S., & Willians, C. F. (1964). Automated instruction for retarded children. American Journal of Mental Deficiency, 69, 405-412.

Price, J. E. (1963). Automated teaching programs with mentally retarded students. American Journal of Mental Deficiency, 68, 69-72.

Richmond, G. (1983). Comparison of automated and human instruction for developmentally retarded preschool children. TASH Journal, 8, 78-84.

Russo, D. C., Krogel, R. L., & Lovaas, O. I. (1978). A comparison of human and automated instruction of autistic children. Journal of Abnormal Child Psychology, 6, 189-201.

Schreibman, L., & Koegel, R. L. (1975). Autism: A defeatable horror. Psychology Today, March 1975, 61-67.

Sidman, M., & Stoddard, L. T. (1967). The effectiveness of fading in programming a simultaneous form discrimination for retarded children. Journal of the Experimental Analysis of Behavior, 10, 3-15.

Sidman, M. & Tailby, W. (1982). Conditional discrimination vs. matching to sample: An expansion of the testing paradigm. Journal of the Experimental Analysis of Behavior, 37, 5-22.

Skinner, B. F. (1953). Science and human behavior. New York: MacMillan.

Skinner, B. F. (1954). The science of learning and the art of teaching. Harvard Educational Review, 24, 84-97.

Skinner, B. F. (1957). Verbal behavior. New York: Appleton-Century-Crofts.

Skinner, B. F. (1961a). Teaching machines. Scientific American, 205, 90-102.

Skinner, B. F. (1961b). Why do we need teaching machines? Harvard Educational Review, 31, 377-398.

Skinner, B. F. (1968). The technology of teaching. Englewood Cliffs, N.J.: Prentice-Hall.

Stolurow, L. M. (1960). Teaching machines and special education. Educational and Psychological Measurement, 20, 429-448.

Urcuioli, P. J., & Honig W. K. (1976). Control of choice in conditional discriminations by sample-specific behaviors. Journal of Experimental Psychology and Behavior Processes, 6, Number 3, 251-277.

Zimmerman, D. W. (1973). Functional laws and reproducible processes in behavior. Psychological Record, 13 163-173.

Ziriax, J. M., & Silberberg, A. (1978). Discrimination and emission of different key-peck durations in the pigeon. Journal of Experimental Psychology: Animal Behavior Processes, 4, 1-21.

BIOGRAPHICAL SKETCH

I was born on the 19th of February, 1949, in Lawrence, Kansas, and attended William Chrisman High School in Independence, Missouri, graduating in 1967. I attended the University of Missouri in Kansas City from 1971 to 1976, majoring in psychology. My advisors at UMKC were Drs. Diane DeArmond and Joe Edwards, students of Drs. Aaron Brownstein and Ogden Lindsley, respectively. I obtained a Bachelor of Arts degree in 1973 and a Master of Arts degree in 1976. I moved to Colorado and worked with delinquent adolescents on the Ute Mountain and Southern Ute Indian Reservations for five years, returning to school at the University of Florida in 1982 in order to pursue a Ph.D. degree. I have two children, Micah (9 years) and Zachary (8 years), and am married to Teresa Rodgers. While attending the University of Florida, I have been employed as a psychologist working with retarded people at Sunland Center in Gainesville.

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Henry S. Pennypacker, Chairman
Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

James M. Johnston, Co-Chairman
Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

Edward F. Malagodi
Professor of Psychology

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

William D. Wolking
Professor of Special Education

I certify that I have read this study and that in my opinion it conforms to acceptable standards of scholarly presentation and is fully adequate, in scope and quality, as a dissertation for the degree of Doctor of Philosophy.

W. Keith Berg
Professor of Psychology

This dissertation was submitted to the Graduate Faculty of the Department of Psychology in the College of Liberal Arts and Sciences and to the Graduate School and was accepted as partial fulfillment of the requirements for the degree of Doctor of Philosophy.

December, 1988

____

Dean, Graduate School